MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY (MUET), JAMSHORO

TENDER DOCUMENTS

FOR

i. 500kVA KIOSK Sub-station No. 15 for the Buildings of Student Service Center & Sports Complex (Gymnasium Hall)

ii. Provision of Street Lighting for the Buildings of Student Service Center & Sports Complex (Gymnasium Hall)

iii. Shifting of Sub-Station No. 06 to New Girls' Hostel

March-2014

NAQVI AND SIDDIQUIE
INC.ARCHITECTS & ENGINEERS
BLOCK NO: 18 FIRST FLOOR
MARKAZ F -6 ISLAMABAD
TEL 051-2876769-2270268

KAD Consultants
Electrical Engineers
F-1, Zaib Residency,70/72/1, Hussain Housing Scheme, Near Summit Bank Wadhu Wah, Qasimabad Hyderabad
Ph: +92-22-2652274, Fax: +92-22-2652275
E-Mail: kad.consultants@hotmail.com

Summary of Contents

INVITATION FOR BIDS

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY

JAMSHORO - 76062, SINDH, PAKISTAN
Telephone: +92-22-2771311 Fax: + 92-22-2771403
Email: saghir.memon@admin.muet.edu.pk, saghir79@hotmail.com

ISO-9001:2008 Certified

DIRECTOR
Works & Services

No.& Dated: Dir(W&S)/MUET/JAM/-55, 11-03-2014

NOTICE INVITING TENDERS.

All the Pre-qualified Contractors / firms / parties meeting eligibility criteria, viz. having registration with Sindh Revenue Board (SRB) and are tax payers of Government, registered with sales tax office as the case may be and are not black listed in any procuring agency or authority, are invited to participate in sealed percentage / item rate tender for the following works:

S. #	Name of Work	Estimated Cost	Tender Fee	Completion Time	Earnest Money	Date of Purchase	Date of Submission of Bids	Purchase From
1	An 500KVA Kiosk Sub-Station No.15 for the buildings of Student Service Centre & Sports Complex (Gymnasium Hall), Provision of Street Lightning for the Building of Student Service Centre & Sports Complex (Gymnasium Hall) and Shifting of Sub-Station No.06 to New Girls Hostel at MUET, Jamshoro.	17.053 (M)	3,000.00	06 Months	2%	19-03-2014 To 07-04-2014	08-04-2014	Executive Engineer (Works)
2	An Extension of Approach Road From Student Service Centre towards the Sports Complex (Gymnasium Hall) at MUET, Jamshoro.	9.594 (M)	3,000.00	06 Months	2%	19-03-2014 To 07-04-2014	08-04-2014	Executive Engineer (Works)
3	Internal / External Electrification, Computer Networking & Air-Conditioning Works of Girls Hostel for 150 Students at MUET, Jamshoro.	11.064 (M)	3,000.00	12 Months	2%	19-03-2014 To 07-04-2014	08-04-2014	Executive Engineer (Works)
4	Establishment of Innovation & Entrepreneurship Centre (IEC) – An Extension of Mehran University Institute of Science, Technology and Development (MUISTD), Jamshoro.	29.805 (M)	3,000.00	24 Months	2%	19-03-2014 To 07-04-2014	08-04-2014	Executive Engineer (Works)

The terms and conditions are given as under:-

The tender documents can be had from the Office of Executive Engineer (Works) on the payment noted above (non-refundable) on any working day except the day of opening of tenders. The sealed tender on prescribed proforma alongwith 2% earnest money of total bid in the form of Pay Order in favour of Executive Engineer (Works) should be deposited in the Office of Executive Engineer (Works) by 08-04-2014 upto 12.00 (Noon) and same will be opened on the same day @ 12.30 P.M in respective office, in presence of the Contractors / representative, who so ever will be present at that time. In case of any unforeseen situation resulting in closure of office on the date of opening or if Government declares Holiday the tender shall be submitted / opened on the next working day at the same time & venue. Any Conditional or un-accompanied of the earnest money, tender will not be considered in the competition.

The Competent Authority reserves the right to reject any or all bids subject to relevant provisions of SPP Rules, 2010 and may cancel the bidding process at any time prior to the acceptance of a bid or proposal under Rule-25" of said Rules.

11/03/14

Director (Works & Service)
MUET, Jamshoro

INSTRUCTIONS
TO BIDDERS
&
BIDDING DATA

Notes on the Instructions to Bidders

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

Matters governing the performance of the Contract or payments under the Contract, or matters affecting the risks, rights, and obligations of the parties under the Contract are not normally included in this Section, but rather in the appropriate sections of the *Conditions of Contract* and/or *Contract Data*.

TABLE OF CONTENTS

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

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

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:

a) duly licensed by the Pakistan Engineering Council (PEC) in the appropriate category for value of works.

Provided that the works costing Rs. 2.5 million or less shall not require any registration with PEC .

b) duly pre-qualified with the Procuring Agency. (*Where required*).

In the event that prequalification of potential bidders has been undertaken, only bids from prequalified bidders will be considered for award of Contract.

c) if prequalification has not undertaken , the procuring agency may ask information and documents not limited to following:-
   (i) company profile;
   (ii) works of similar nature and size for each performed in last *3/5* years;
   (iii) construction equipments;
   (iv) qualification and experience of technical personnel and key site management;

(v) financial statement of last 3 years;
(vi) information regarding litigations and abandoned works if any.

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 quarries 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 a 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 16.9, 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 satisfactory perform the Contract in accordance with the provisions of the IB.18.

19.2 Not withstanding 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 ----% 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

The following specific data for the works to be tendered shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.

Instructions to Bidders
Clause Reference

1.1 **Name of Procuring Agency:** Mehran University of Engineering and Technology (MUET), Jamshoro.

Brief Description of Works: This work consists of;

a) 500kVA KIOSK Sub-station No. 15 for the Buildings of Student Service Center & Sports Complex (Gymnasium Hall)
b) Provision of Street Lighting for the Buildings of Student Service Center & Sports Complex (Gymnasium Hall)
c) Shifting of Sub-Station No. 06 to New Girls' Hostel

5.1 (a) Procuring Agency's address: Office of the Executive Engineer (Works), Mehran University of Engineering & Technology (MUET), Jamshoro

(b) Engineer's address:

KAD Consultants
Electrical Engineers
F-1, Zaib Residency, Hussain Housing Scheme, Near Summit Bank Wadhu Wah, Qasimabad Hyderabad
PH# +92-22-2652274
FAX# +92-22-2652275
E-mail: kad.consultants@hotmail.com

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

11.2 The bidder has the financial, technical and constructional capability necessary to perform the Contract as follows:

i. Financial capacity: (must have annual average turnover of Rs20Million of last 3 years);
ii. Technical capacity: Category of registration with PEC C-6 or above

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/Earnest Money:** 2% of total bid amount

14.1 **Period of Bid Validity:** 90 days

14.4 **Number of Copies of the Bid to be submitted:** One original plus 2 copies.

14.6 (a) **Procuring Agency's Address for the Purpose of Bid Submission:**
Office of the Executive Engineer (Works), Mehran University of Engineering & Technology (MUET), Jamshoro

15.1 **Deadline for Submission of Bids:** Time: 12:00 noon Date: 08-04-2014.

16.1 **Venue, Time, and Date of Bid Opening**

Venue: Office of the Executive Engineer (Works), Mehran University of Engineering & Technology (MUET), Jamshoro

Time: 12:30PM **Date:** 08-04-2014

16.4 **Responsiveness of Bids**

(i) Bid is valid till required period

(ii) Bid prices are firm during currency of contract/Fixed Price Contract
(iii) Completion period offered is within specified limits
(iv) Pre-qualified Bidders are 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.

(a) **Fixed Price contract**: In these contracts no escalation will be provided during currency of the contract

(b) **Price adjustment contract**: In these contracts escalation will be paid only on those items and in the manner as notified by Finance Department, Government of Sindh, after bid opening during currency of the contract.**(NOT APPLICABLE)**

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

* *[To be prepared by the Engineer/Procuring Agency]*

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 Systeme Internationale d' Unites (SI Units).

_____

_____

(Note: The abbreviations to be used in the Schedule of Prices to be defined by the Procuring Agency).

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, the premium, 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. Such cost shall be inbuilt in his quoted rates.

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.

6. Provisional Sums and Day work

6.1 Provisional Sums included and so designated in the Schedule of Prices if any, shall be expended in whole or in part at the direction and discretion of the Engineer/Procuring Agency. The Contractor will only receive payment in respect of Provisional Sums, if he has been instructed by the Engineer/Procuring Agency to utilize such sums.

6.2 Day work rates in the contractor's bid are to be used for small additional amounts of work and only when the Engineer have given written instructions in advance for additional work to be paid for in that way.

SCHEDULE OF PRICES – SUMMARY OF BID PRICES (Sample)

Bill No.	Description	Total Amount (Rs)
	(A) Building Work	
1.	Civil works	
2	Internal sanitary and water supply	
3	Electrification	
4	External Development works	
5	Miscellaneous Items	
	(B) Road Work.	
1.	Earthwork	
2.	Hard Crust and Surface Treatment	
3.	Culverts and Bridges	
4.	Miscellaneous Items	
	(C) Public Health Engineering Works.	
1.	Earthwork	
2.	Subsurface Drains	
3.	Pipe Laying and Man holes	
4.	Tube wells, Pump houses	
5.	Compound wall	
6.	Miscellaneous Items	
	DELETED	
	Total Bid Price (The amount to be entered in Paragraph 1 of the Form of Bid) (In words).	

SCHEDULE OF PRICES

Item No.	Description	Quantity	Unit Rate(Rs)	Total Amount (Rs)
	I. (Civil works)			
1.				
2.				
3.				
	II.Internal sanitary and water supply.			
1.				
2.				
3.				
	III. Electrification.			
1.				
2.				
3.				
	IV. External Development works.			
1.				
2.				
3.				
1.	**V. Miscellaneous Items**			
2.				
3.				
Total (*to be carried to Summary of Bid Price*) *Add/ Deduct the percentage quoted above/below on the prices of items based on Composite Schedule of Rates.*				

*SPECIFIC WORKS DATA

(To be prepared and incorporated by the Procuring Agency)

NOT APPLICABLE

**(Note: The Procuring Agency shall spell out the information & data required to be filled out by the bidder and to furnish complementary information).*

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. *(attach evidence)*

NOT APPLICABLE

Note:

* *The Procuring Agency should decide whether to allow subcontracting or not.*

In case Procuring Agency decides to allow subcontracting then following conditions shall be complied with:

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.

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 time the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Contractor] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from PA.

.....
[Procuring Agency]

[Contractor]

CONDITIONS OF CONTRACT

TABLE OF CONTENTS

CONDITIONS OF CONTRACT

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, licences 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 Maintenances 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 demobilise 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 demobilise 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 Separately

1.1.4 **The Procuring Agency** means— the person or entity 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. Here P/A is Mehran University of Engineering & Technology (MUET), Jamshoro

1.1.5 **The Contractor** means a firm which is employed by the P/A. A contractor is responsible for providing all of the material, labor, equipment and services necessary for the construction of the project.

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

1.1.9 Time of Completion 06 Months

1.1.20 Engineer

KAD Consultants
Electrical Engineers
F-1, Zaib Residency, Hussain Housing Scheme, Near Summit Bank
WadhuWah, Qasimabad Hyderabad
PH# +92-22-2652274
FAX# +92-22-2652275
E-mail: kad.consultants@hotmail.com

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

(a) The Contract Agreement
(b) Letter of Acceptance
(c) The completed Form of Bid
(d) Contract Data
(e) Conditions of Contract
(f) Bill of Quantities (BOQ)
(g) The Drawings
(h) The Specifications
(i) Special Conditions of Contract

2.1 Provision of Site: On the Commencement Date

3.1 Authorized person: Executive Engineer (Works), MUET, Jamshoro

3.2 Name and address of Engineer's/Procuring Agency's representative:
Office of the Executive Engineer (Works), Mehran University of Engineering & Technology (MUET), Jamshoro.

4.4 **Performance Security:**

Contractor to submit performance insurance guarantee equal to 10% of contract amount from any of following insurance companies in the specified form. No mobilization shall be paid until contractor has signed the agreement and submitted performance guarantee.

a) EFU General Insurance Limited.
b) Adamjee Insurance Company Limited.
c) National Insurance Corporation Limited.
d) Pakistan General Insurance Company limited.

5.1 **Requirements for Contractor's design (if any):** Contractor to confirm design of all cables/equipment.

7.2 **Programme:**
Time for submission: Within fourteen (14) days of the Commencement Date.
Form of programme: *Bar Chart / CPM/PERT*

7.4 Amount payable due to failure to complete shall be 0.05% per day up to a maximum of (10%) of sum stated in the Letter of Acceptance

7.5 Early Completion (Not Applicable)
In case of earlier completion of the Work, the Contractor is entitled to be paid bonus up to limit and at a rate equivalent to 50% of the relevant limit and rate of liquidated damages stated in the contract data.

9.1 Period for remedying defects (Defects Liability Period): 6 Months

10.2 (e) **Variation procedures: (Not Applicable)**
Day work rates_____(details)

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:

(j) 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 1/5th 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.

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 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:

a. landed cost of imported materials, or
b. ex-factory / ex-warehouse price of locally manufactured or produced materials, or
c. market price of stands other materials.

(vii) Secured Advance should not be allowed unless &until the previous advance, if an, 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,l 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 certification the light of later information.

(v) Retention money and other advances are to be recovered from the bill submitted by contractor.

11.2 *(a) **Valuation of the Works:**

Measurement of executed quantities at quoted rates.

11.3 Percentage of retention: Ten percent (10%), which also includes two percent (2%) bid security.

11.6 Currency of payment: Pak Rupees

14.1 Insurances: (Not Applicable)

Type of cover
The works

Amount of cover

The sum stated in the letter of acceptance plus fifteen percent

Type of cover
Contractor's equipment

Amount of cover
Full replacement cost

Type of cover
Third party injury to persons and damage of property

Workers:

Other cover:

14.2 Amount to be recovered (not applicable)

Premium plus_____ percent (%)

15.3 Arbitration

Place of Arbitration MUET, Jamshoro

STANDARD FORMS

(Note: Standard Forms provided in this document for securities are to be issued by a bank. In case the bidder chooses to issue a bond for accompanying his bid or performance of contract or receipt of advance, the relevant format shall be tailored accordingly without changing the spirit of the Forms of securities).

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. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name, Title & Address)

1. Signature _____
2. Name _____
3. Title _____

_____
Corporate Guarantor (Seal)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____ day of _____ 200 _____ 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

(Seal)

Signature of the Procuring Agency

(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:

(Name, Title and Address)

Witness:

(Name, Title and Address)

MOBILIZATION ADVANCE GUARANTEE

Guarantee No._____

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 of ..... ----- ..... ----------.....-197--"- 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 the .... —..... ----- for an advance to him of Rupees ----------. (Rs. .....) on the security of materials absolutely belonging to him and brought by him to the site of the said works the subject of the said agreement for use in the construction of such of the said works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charge) AND WHEREAS the Government has agreed to advance to the Contractor the sum of Rupees, (Rs. .....) on the security of materials the quantities and other particulars of which are detailed in Part II of Running Account Bill (E). the said works signed by the contractor

Fin R.Form.17.A

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

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

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

(1) That the said sum of Rupees .....- ..... ----------..... ---------- (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
Fin. R. Form No. 17-A
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 grater degree than is due to reasonable use and wear thereof Contractor will forthwith replace the same with other materials of like qualify 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 not withstanding anything in the said agreement and without prejudice to the powers contained therein if and whether the covenant for payment and repayment hereinbefore contained shall become enforceable and the money owing shall not be paid to accordingly.

Once 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

SPECIFICATIONS

FOR

ELECTRICAL WORKS

TABLE OF CONTENTS

1. GENERAL

1.1 SCOPE

These general specifications cover the details of Sub-Station Equipment (Transformers, HT Panels, Bus Trunkings/Rising Mains and other related items) to be supplied, the inspection as may be necessary before dispatch, delivery at site, installations, testing, commissioning, putting into operation and handing over in working condition of the equipment for sub-stations for working voltage of 11000/415 volts. The general specifications are subject to revision from time to time. The tender specifications for a particular job shall clearly indicate the applicable version of these specifications.

These however do not bind the NIT approving authority from incorporating better and new, technologically superior, products judiciously.

1.1.1 Related Documents

These technical specifications shall be read in conjunction with the standard conditions of the contract with correction slips, as are relevant for commercial aspects, as well as schedules and drawing and requirements under these specifications.

In the event of any discrepancy between these specifications and inter connected documents, the technical requirements as per the contract specifications shall be followed and deemed to be having overriding value.

1.2 DEFINITIONS

The definitions of terms are in accordance with relevant International/WAPDA/PEPCO/HESCO standards.

Medium Voltage (MV)	:	Normally exceeding 250 V but not exceeding 650 V
High Voltage (HV)	:	Normally exceeding 650 V but not exceeding 11 kV

1.3 SYSTEM ENGINEERING

1.3.1 General

Transformers, High Voltage Panel, Medium Voltage (MV) Panels, Inter-connecting Cables, Bus Ducts, Protection and Metering etc. individually engineered in each case, depending upon the requirements, size and

capacity of sub-station and in coordination with the licensee of the area concerned.

It may also be necessary to install capacitor banks/other modern systems to improve power factor, simultaneously controlling the Harmonics, for economy consideration as well as to comply with the requirements of local utility. Metering aspects as well as protection arrangements will also depend upon the Licensee's requirements.

1.3.2. Items of Work

A sub-station installation work shall generally comprise of supply, installation, testing and commissioning of the following:

(i) High Voltage Panels
(ii) Step down Transformers, complete with associated auxiliaries as specified
(iii) High voltage cable for inter-connection between the H.V. panel and transformers including terminations
(iv) M.V. Panel(s)
(v) L.T. cable, for up-to 400 kVA Transformers and Bus trunking for higher than 400 kVA transformers, inter-connection between transformer's M.V. terminals and the M.V. Panel as specified
(vi) Power factor improvement capacitors/ Power Conditioner Savers
(vii) Earthing system
(viii) Safety Equipment
(ix) Emergency M.V. Panel if required
(x) Miscellaneous items

1.4 INFORMATIONS AND DRAWINGS TO BE SUPPLIED BY THE TENDERING AUTHORITY

1.4.1 Specification Drawing

The tender specifications shall indicate, for a particular job, the reference drawings to help the contractor to work out the tender. The drawings shall also indicate the schematic of main connections and shall form part of the specifications. All the drawings specified and issued with the tender are for purpose of tendering only and shall be deemed to be specification drawings.

1.4.2 Schedule of Work

The department shall supply a schematic diagram and a schedule of work as per detail attached as the equipment; materials required type (List of Approved Electrical Manufacturers) and anticipated quantity/numbers (BOQ) in respect of each item.

1.5 WORKS TO BE ARRANGED BY THE CONTRACTOR

Unless otherwise mentioned in the tender specifications the following works shall be carried out by the contractor (i.e. the contents of the BOQ will be applicable or to be done with the permission of Engineer i/c).

(i) Cable trench, entry pipe for cable, manholes for drawing of cables, manhole covers etc. as per requirements

(ii) Construction of necessary soak pits, drainage arrangement for soak pit etc., if required

(iii) Provision of storage space at site during the contract period free of cost

(iv) In addition, to supply, installation, testing and commissioning of all equipment as per schedule of work the following work shall be deemed to be included within the scope of work, to be executed by the contractor.

  (a) All minor building works, such as equipment foundation if required cutting and making good holes, grouting of channels belts as required. Cutting and making good damages etc.

  (b) Provision of supports / clamps for equipment, cables etc. wherever required

  (c) Small wiring, inter-connection etc. inclusive of all materials and accessories, necessary to comply with the regulations as well as proper and trouble free operation of the equipment

  (d) Closing of the cable entry points in sub-station against seepage of water, rodents etc.

  (e) Tools and tackles required for handling and installation

  (f) Necessary testing equipment for commissioning

  (g) Watch and Ward of materials and/or installation and equipment till their handing over to the department

1.7 SITE CONDITIONS

All the equipment and their installation shall be suitable for the environmental conditions encountered at the location.

1.8 INSPECTION OF SITE AND COLLECTION OF DATA

The contractor shall be deemed to have examined the tender documents, detailed specification, data etc. and to have visited the site or ascertained all relevant details for offering suitable equipment / installation.

1.9 INTER CHANGEABILITY

All similar equipment, materials, removable parts of similar equipment etc. shall be inter-changeable with each other.

1.10 INTERFACE WITH COMMUNICATION EQUIPMENT

Suppressors or other protection devices shall be provided, if required, wherever the sub-station installation is likely to interfere during the operation with any other electric or electronic equipment and/or telephone/data cables/equipment.

1.11 EXTENT OF WORK

The scope of work shall consist of cost of all materials, labor i/c supervision, installation, calibration, adjustments as required for commissioning of the sub-station. The term complete installation shall mean, not only, major item of the plant and the equipment covered by these specifications, but also, incidental sundry components necessary for complete execution and satisfactory performance of installation with all labor charges, whether or not specifically mentioned in the tender documents, which shall be provided by the contractor at no extra cost.

1.12 COMPLETENESS OF TENDER

All fittings, unit assemblies accessories, hardware foundation bolts, terminals blocks for connections, cable glands and miscellaneous materials and accessories of items of work which are useful and necessary for efficient assembly and working of the equipment shall be deemed to have been included within the scope of the work in the tender and within the overall details for complete item whether they have been specifically mentioned or not.

1.13 DATA MANUALS AND DRAWINGS TO BE FURNISHED BY CONTRACTOR

1.13.1 After Award of Work

The contractor shall submit the following drawing within a fortnight of the award of the work or as specified in tender document which shall prevail, for approval by the department.

(i) General arrangement or location drawing of the equipment complete with dimensions and clearances

(ii) General arrangement drawing of H.V. Panel, Transformers, M.V. panels, Earthing, Cable route etc. including details of grouting of channels / bolts of various equipment

(iii) All panels' schematics & wiring diagram including control wiring

(iv) Bar chart indicating general program for supply, installation, testing and commissioning and handing over

(v) Any other drawing or data that may be necessary for the job

1.13.2 **Before Commencement of Installation**

The contractor shall also furnish three copies of detailed installation, operation and maintenance manuals of manufacturers for all items of equipment together with all relevant data sheet, spare parts, catalogues, repairs, assembly and adjustment procedure etc.

1.14 QUALITY OF MATERIALS AND WORKMANSHIP

All parts of equipment shall be of such design, size and material so as to function satisfactorily under all rated conditions of loading and operation. All components of the equipment shall have adequate factors of safety. Materials/components which are not conforming to standards laid down by British Standards Specification (BSS)/WAPDA/PEPCO/HESCO shall be got approved from the department before use on the work.

The entire work of fabrication, assembly and installation shall conform to sound engineering practice and on the basis of "fail safe" design. The mechanical parts subject to wear and tear shall be of easily replaceable type.

The construction shall be such as to facilitate ease of operation, inspection, maintenance and repairs. All apparatus shall also be designed to ensure satisfactory operation under working conditions as specified.

1.15 INSPECTION, TESTING AT MANUFACTURERS WORK

The contractor will be required to furnish such facilities as will be necessary for inspection of the equipment before dispatch at the manufacturer's works and also for witnessing such tests, at the works, if so required by the department. The contractor shall furnish information for this purpose and will also give sufficient notice regarding the dates proposed for such test to Inspection agency.

1.16 TEST CERTIFICATE

Copies of all documents for routine, acceptance and type test certificates of the equipment carried out at the manufacturers premise shall be furnished to the department along with supply of the equipment.

1.17 SCHEDULE OF TECHNICAL DATA & SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

Copies of Schedule of Technical Data (as per format provided in the specifications) as well as Schedule of Guaranteed Technical Data/Particulars of each sub-station shall be furnished by the contractor for approval by the Engineer In-charge, prior to placing of order to the manufacturer.

1.18 DISPATCH OF MATERIALS AND STORAGE

The contractor shall commence work as soon as the drawings submitted by him are approved. The contractor should dispatch all materials to site in consultation with the department where suitable storage accommodation may be made available to him temporarily. For this purpose the program of dispatches of materials shall be framed keeping in view the building progress so that suitable storage accommodation could be made available to the contractor. Safe custody of all machinery and equipment supplied by the contractor shall be his own responsibility till the final taking over.

1.19 COORDINATION WITH OTHER AGENCIES

The contractor shall coordinate his work and cooperate with other agencies by exchange of all technical information like details of foundation if required, weight, over all dimensions, clearance and other technical data required for successful and proper completion of his portion of the work in relation to the work of others without any reservation. No remuneration should be claimed from the department for such technical cooperation. Care shall be taken not to damage the water proofing done in the case of substations constructed below ground level. If any unreasonable hindrance is caused to other agencies and any completed portion of the works has to be dismantled and redone for want of the cooperation and coordination by the contractor during the course of work, such expenditure incurred will be recovered from the contractor during the course of work, if the restoration work to the original condition of specification of the dismantled portion of the work was not under taken by the contractor.

1.20 CARE OF BUILDINGS

Care shall be taken, while handling/ installing the equipment to avoid damage to the building. On completion of the installation, the contractor shall arrange to repair all damages to the building caused during plant installation so as to bring to the original condition. He shall also arrange to remove all unwanted waste materials from sub-station room and other areas used by him.

1.21 PAINTING AND PROTECTION

All damages to painting during transport and installation shall be set right to the satisfaction of the department before handing over. All structural frame work for support of various items of equipment shall be given the final coat of paint of approved shade at site after erection is complete. Additional protection measures against corrosion shall be provided when installed in special environment.

1.22 TRAINING OF DEPARTMENTAL PERSONNEL

The operation and maintenance staff of the WAPDA / PEPCO / HESCO / Engineer In charge / Engineer's Representative shall be associated with the contractor's personnel during the installation, testing and commissioning of the equipment.

1.23 COMPLETION DRAWING

Three sets of completion drawings comprising the following shall be submitted by the contractor while handing over the installation:

(i) Equipment layout drawing(s) giving complete details of the entire equipment

(ii) Electrical drawings for the entire electrical equipment showing cable sizes, equipment capacities, switch-gear's ratings, control components, control wiring etc.

(iii) Schematic diagram of the entire sub-station installation

1.24 FINAL INSPECTION AND TESTING

When the installation is complete, the contractor shall arrange for inspection and testing of the installation. Test results obtained shall be recorded. The installation shall not be accepted until it complies with the requirement of these Specifications. The Sub-Station installation shall be got inspected by the contractor from WAPDA/PEPCO/HESCO/Engineer In-charge/Engineer's Representative and their clearance taken before energizing the Sub-Station. All the observations/deficiencies pointed out by the inspecting authorities shall comply with by the contractor on priority. The department shall render all help and pay mandatory charges to WAPDA/PEPCO/HESCO, if any, in this regard.

1.25 DATE OF ACCEPTANCE

The contractor shall operate the sub-station for a period of fifteen days after it is energized. The date of taking over of the sub-station shall be reckoned after its trouble free operation during this running period.

1.26 GUARANTEE

The contractor shall guarantee the entire sub-station installation as per specifications. All equipment shall be guaranteed for one year from the date of acceptance against unsatisfactory performance or breakdown due to defective design, manufacture and installation. The installation shall be covered by the conditions that whole installation or any part there of found defective within one year from the date of taking over shall be replaced or repaired by the contractor free of charge as decided by the Engineer In-charge. The warranty shall cover the following;

(i) Quality, strength and performance of materials used.

(ii) Safe mechanical and electrical stress on all parts under all specified conditions of operation.

(iii) Satisfactory operation during the maintenance period.

(iv) Performance figures and other particulars as specified by the contractor under schedule of guaranteed technical particulars.

1.27 AFTER SALES SERVICES

The contractor shall ensure availability of adequate and prompt after sales services in the market in the form of maintenance personnel and spares as and when required with a view to minimizing the breakdown period. Particular attention shall be given to ensure that all spares are easily available during the normal life of installation.

2. 11 KV METAL CLAD SWITCHGEAR

2.1 SCOPE

This specification applies to 11 kV A.C. three phase metal clad switchgear for indoor application. The switchgear covered by this specification comprises of vacuum type circuit breakers.

2.2 Reference Standards

2.2.1 The switchgear, including the operating devices and the auxiliary equipment form and integral part of it, shall be designed, manufactured and tested in accordance with the following International Electrotechnical Commission (IEC) Publications amended or revised to date;

IEC – 298 (1990)	A.C. Metal-enclosed Switchgear and Control gear
IEC – 694 (1990)	Common clauses for high voltage switchgear and control-gear standards
IEC – 185 (1987)	Current Transformer
IEC – 265 – 1 (1983)	High Voltage Switches
IEC – 51 – 1 (1984)	Direct acting, indicating analogue electrical measuring instruments and their accessories
IEC – 51 – 2 (1984)	-Do-
IEC – 51 – 3 (1984)	-Do-
IEC – 51 – 5 (1985)	-Do-
IEC – 51 – 8 (1985)	-Do-

IEC – 468 (1974)	Method of measurements of resistivity of metallic materials

The switchgear incorporating vacuum circuit breakers may be tested for X-Radiations in accordance with American National Standards ANSI C37.85 – 1972 as mended to date or other approved standard.

The definitions given in the above standards shall apply herein.

In case, any requirement laid down herein differs from that given in the above standards, the switchgear shall comply with the requirements given herein.

2.3 SERVICE CONDITIONS

2.3.1 Climatic Conditions

2.3.1.1 ***Atmospheric Conditions***

It may be assumed that the air is not normally heavily polluted by dust, smoke corrosive or flammable gases, vapours or salt. However, at certain times of the year, severe dust storms may be experienced. Fine dust particles are present in the air and these are deposited an exposed surfaces.

2.3.1.2 ***Ambient Temperature***

Maximum	50 °C
Maximum mean over any 24 hours	45 °C
Mean in any year	30 °C
Minimum	-10 °C

2.3.1.3 ***Relative Humidity***

Relative humidity may range up to 100%. The maximum value of the ambient temperature and humidity, however, do not occur simultaneously. During the monsoons, high humidity may persist for many days at a time.

2.3.1.4 ***Supply System***

The switchgear shall be suitable for installation in 11 kV three-phase A.C. supply system of the following characteristics;

Nominal System Voltage	11kV
Rated Voltage	12 kV
Frequency	50 Hz

2.4 General Requirements

2.4.1 General

2.4.1.1 The switchgear and all the accessories shall be so constructed and designed as to comply with all requirements set out in this specifications.

2.4.1.2 The switchgear shall be designed for indoor use and to be mounted on floor.

2.4.1.3 The switchgear will be supplied in the form of simple panels or in the form of switchboard comprising of a number of individual panels as may be required. Each panel will comprise of a draw out type circuit breaker and shall be capable of being connected to a switchboard on either side.

Note: when a board is ordered a continuous bus with one or two joints in the board may be allowed on a written request from the manufacturers.

2.4.1.4 All the associated equipment shall be self-contained and self-supporting.

2.4.1.5 In each panel the circuit breaker shall be arranged with a mechanism for moving it physically between the connected and disconnected positions and equipped with self-aligning and self-coupling primary disconnecting devices.

2.4.1.6 All live parts such as circuit breakers, bus bars, voltage transformers, current transformers etc. shall be enclosed within grounded metal compartments separated by ground metal barriers. Automatic shutters shall be provided to prevent exposure of live parts.

2.4.1.7 Bus bars and their connections shall be insulated as follows;

The bus bars shall be completely covered with insulation capable of withstanding twice the rated voltage. This insulation shall be of non-corrosive, non-tracking, flame-retardant and heat shrinkable type to ensure that it fully adheres to bus bar. The material of insulating sleeves and bus bar joint covers shall not melt, crack, split, drip, flow or ignite when bus bar temperature is raised to 280^{0} C by an induced current nor shall burn when subjected to effects of power arc of 15 kV for one second. The supplier shall provide test reports for the above mentioned properties in accordance with IEC/ASTM or equivalent standard.

2.4.1.8 Mechanical interlocks shall be provided so as to ensure safe operation of the switchgear in the correct sequence as laid down in clause 2.4.7.

2.4.1.9 All the secondary circuits, wiring and instruments, meters, relays etc., shall as far as possible be isolated by grounded metal barriers from all primary circuit elements with exception of short lengths of wire such as at instrument transformer terminals.

2.4.1.10 Switchgear shall be designed and manufactured to secure safety during operation, inspection, cleaning and maintenance and shall be so arranged as to minimize the risk of fire arising or spreading. Each switchgear panel

shall be completely covered on both sides to ensure against spreading of fire to the adjacent panels. In this connection, appropriate means shall be adopted for covering the bus bar connections to the adjacent panels on both sides with suitable epoxy insulation and arranging the same in such a way as no to leave any unnecessary openings between the panels without compromising the requirements for insulation/clearances and temperature rise.

2.4.1.11 Standardization of Panels

2.4.1.11.1 Panels manufactured by different manufacturers shall be interchangeable. To accomplish this basic requirement, certain dimensions of the panels shall be as per WAPDA/PEPCO/HESCO standards. The panels will be manufactured in accordance with these drawings as applicable.

2.4.1.11.2 The following components shall be standardized;

C.Ts & PTs
The terminals size, the mounting dimensions and other leading dimensions required for interchangeability shall be of WAPDA/PEPCO/HESCO standards.

Supporting Insulators
The dimensions required for interchangeability will be approved by the design (T&G) department WAPDA/PEPCO/HESCO.

Bus Bars
The bus bar sizes and positions shall be of required standards.

Panels	**Size (mm)**
Incoming, and Outgoing	
(i) 25 kA rating	2x100x10

The design of joints, their location and size of bolts etc. shall be of normal standard.

2.4.1.12 At every panel, the incoming AC/DC circuits shall be connected to the terminal block of the terminal from where the supply shall further be distributed through miniature circuit breakers of appropriate rating and characteristics.

2.4.2 Standard Type of Panels

2.4.2.1 The switchgear shall be of the following types;

(i) Incoming panel for connecting the 11 kV supply to outgoing panel
(ii) Outgoing panel for connecting supply to the transformer

2.4.3 Interchangeability

2.4.3.1 All removable components of the same type and rating in a given assembly shall be physically and electrically interchangeable.

2.4.3.2 All removable components with different type and ratings shall not be interchangeable.

2.4.4 Short Circuit Strength

The switchgear, all apparatus and connections shall be so supported and proportioned as to be capable of safely withstanding stresses to which they may be subjected during service including those due to short circuit of 25 kA required and under the climatic conditions specified herein.

2.4.4.2 Each panel shall be designed to carry and withstand thermal and mechanical stresses caused by the following rated currents;

		25 kA Panel
(i)	Rated normal current (for main-circuits)	630 A & 2500 A
(ii)	Rated short-time (1 sec) withstand current (for main and earthing circuits)	25 kA
(iii)	Rated peak withstand current (for main and earthing circuits	63 kA

2.4.5 Insulation and Clearance

2.4.5.1 Individual panels and switchboard shall be designed for the following insulation level.

(i) Rated lighting impulse, withstand voltage 95 kV
(ii) Rated power frequency, withstand voltage 36 kV (r.m.s.)

2.4.5.2 The minimum clearance in air shall be as under;

Phase-to-Phase clearance	160 mm
Phase-to-ground clearance	160 mm

2.4.5.3 The insulation sheets, covers, and sleeves shall be made of material having good fire resistant properties. Materials liable to catch fire shall not be used in construction of the panels. In this regard, particular care shall be taken in selecting the appropriate insulating materials, covers and sleeves etc. which shall essentially and non-inflammable properties such as reinforced fiber glass, epoxy, and resins with respect to mechanical, electrical and thermal requirements. In no case, ordinary, PVC, not having required insulating and temperature grade, shall be used anywhere in the

panel. Complete details regarding mechanical material processed to be used at various locations in the panel shall be supplied for approval.

Note: At locations such as breaker terminals or interconnection where it is not possible to meet the above clearances, smaller clearances with insulation will be permitted subject to approval and passing insulation withstands test.

2.4.6 Earthing

2.4.6.1 All metal parts of a switchgear panel shall be effectively bonded together. Hinged doors shall be connected to the panel body by means of flexible copper earthing strips having minimum 30 mm^2 cross-section. The hinges shall not be relied upon for effective earthing.

2.4.6.2 Each panel shall be provided with a copper earth strip of cross-section 25x5 mm and all earthed parts shall be firmly bonded to it. The earth strip shall be so arranged that the strips of adjacent panels can be brought out at both ends of the panel and connected together on the either side as required to form a common earth bus. The required interconnection pieces for connecting earth bus bars of adjacent panels shall be supplied by the manufacturer.

The earthing connections of the auxiliary equipment e.g. C.Ts & P.Ts etc. to the main earth bus bar shall be made by means of 16 mm^2 solid or flexible insulated copper cable. All 11 kV cable glands/brackets shall be connected to the main earth bus bar by means of 25x5 mm solid copper strip.

The metallic parts of a withdrawble part which are normally earthed shall also remain earth connected in the test and disconnected position and also in any intermediate position whilst the auxiliary circuits are not totally disconnected.

The continuity of all earthing circuits shall be ensured taking into account the thermal and mechanical stresses caused by the current that they may have to carry.

2.4.6.3 In a switchboard two independent external earthing points shall be brought out. One point shall be at the incoming panel and the other from the extreme outgoing panel in the board. Earthing terminals for taking 7 to 15 mm dia copper wire for connection to the sub-station earthing system shall be provided.

2.4.7 Interlocks

2.4.7.1 The switchgear shall be provided with an interlocking system which ensures safe operation in the correct sequence of the equipment under all service conditions.

2.4.7.2 Mechanical interlocks shall be sturdy construction and designed for easy and reliable operation. Such interlocks shall be preventive and shall be effective at the point where pressure is applied so that stress cannot be transferred to parts remote from that point.

2.4.7.3 At least following mechanical interlocks shall be provided;

(i) The withdrawal or engagement of circuit breaker shall be possible unless it is in the open position

(ii) The operation of a circuit breaker shall not be possible unless it is in service, disconnected, and removed, test or earthing position.

(iii) It shall be impossible to close the circuit breaker in the service position unless it is connected to the auxiliary circuit. Similarly, disconnection of the auxiliary circuit socket while the circuit breaker is in service position shall automatically trip the latter

(iv) Complete withdrawal of the circuit breaker shall not be possible unless auxiliary circuits is disconnected

2.4.7.4 In addition, the manufacturer shall provide sufficient number of interlocks to provide full safety for the operation when parts of the circuit breaker or its mechanism mal function during the operation of the switchgear. A list and mode of operation of all such interlocks shall be supplied with the offer.

2.4.8 Operating Device Movement

2.4.8.1 Wherever possible, the direction of motion of operating device and handle shall be in accordance with the following.

2.4.8.2 Rotary handles shall be moved clockwise for switching ON and counter clockwise for switch OFF.

2.4.8.3 Handles and levers with an essentially straight line movement shall move upwards or to the right (in case of handles moving vertically or horizontally respectively) for a closing operation and shall move in the opposite direction for an opening operation. Handles moving horizontally and away from or towards the operator shall be moved away from the operator for a closing operation and towards the operator for an opening operation.

2.4.8.4 For push or pull buttons which are located one above the other, the upper button be the ON button and the lower button shall be the OFF button. For push buttons placed side by side, the right hand button shall be the ON button and left hand button shall be the OFF button. The ON button shall be colored red and the OFF button shall be colored green.

2.4.9 Circuit Connection

2.4.9.1 Incoming Panel

Each incoming panel shall have provision of incoming LBS either by means of underground cables or by overhead bus duct. Space shall be provided for the following cable connections with dry termination.

i. Appropriate Nos. of single core of appropriate size cross linked polyethylene (XLPE) copper cable for 25kA incoming panel.

The bus duct shall be of appropriate size and design.

The manufacturer shall provide terminals with high tensile steel bolts, nuts and washers for cable

Provision shall be made to endure complete vermin proofing of the cable entry holes.

2.5 INCOMING PANEL

2.5.1 General

Each incoming Panel of 25 kA breaking capacity shall comprise the following equipment:

(i) One load break switch
(ii) Three current transformers for over current protection and metering.
(iii) Three single potential transformers.
(iv) Digital Ammeter & Voltmeter
(v) One Phase selector switch for each ammeter and voltmeter
(vi) One capacitor trip unit
(vii) Two ON/OFF indication lights
(viii) Circuit breakers (SP & TP) for control
(ix) Insulators
(x) One anti-condensation heater
(xi) Three surge arrestor

2.5.2 Current Transformers

2.5.2.1 The Current transformers shall generally be supplied as specified in clause 2.10.

2.5.2.2 The ratio of current transformers to be fitted in the incoming panels for overcurrent protection and metering shall be 25/5/5A~250/5/5Amps.

2.5.6 Voltage Transformers

2.5.6.1 The Voltage transformers shall be supplied in accordance with clause 2.10.

2.5.6.2 No fuses shall be provided on HT or LT side. For protection against short circuit on secondary side, a triple pole A.C. miniature circuit breaker having following characteristics shall be installed in the metering compartment;

- Rated Voltage 250 Volt A-C
- Rated Current 5 Amps
- Rated breaking Current 0.2 kA
- Maximum operating time at rated breaking current < 500 m/s

2.5.6.3 The Voltage transformers shall be so installed as to be energized prior to the closing of the LBS and shall be capable of convenient isolation from the bus bars.

2.5.7 Instruments and Meters

2.5.7.1 Each incoming panels shall be equipped with the following instruments and meters fixed;

- One Voltmeter 0-15 KV with selector Switch
- Three ammeters (C.T operated). One in each Phase
- The above instruments shall be supplied as per clause 2.12.4.

2.5.8 Hooter

One hooter shall be provided in each incoming panel to indicate failure of healthy trip circuit and tripping of breaker. This arrangement should be self-contained and securely fixed to the panel. The alarm cancelling arrangement shall be flush mounted on the front of the panel.

2.5.9 Cable Termination Pad

Adequate facilities for terminating cables shall be provided as required in clause 2.4.9

2.5.10 Signaling Lamps

- For each incoming panel, two signal lamps "RED" and "GREEN" shall be provided to indicate "ON" and "OFF" position of the LBS respectively.
- The indicating lamps shall be of neon type with screwed base of E- 10 and rated 5 Watts at 150 Volts. The lamps shall be supplied from the secondary of the voltage transformers.
- The relative position of the red signal lamp shall be to the right and green lamp shall be to the left.

2.6 OUTGOING PANEL

Outgoing panel of 25 KA breaking Capacity shall comprise the following equipment.

- One Load Break Switch
- Three current transformers
- Protection and metering and space for three current transformers
- Instruments
- UVT Relay
- Cable Termination Pad
- Signaling Lamp

2.6.1 Current Transformers

The current Transformers shall be supplied in accordance with Clause 2.10. The ratio of current transformers shall be 25/5/5A~250/5/5Amps.

2.6.2 Instruments & Meters

2.6.2.1 One ammeter of the scale range as per clause 2.12.4.1 shall be provided. It shall meet the requirements of Clause 2.12.

2.6.2.3 Cable termination pad shall be provided.

2.6.2.4 Adequate to terminating facilities for cables shall be provided as required in Clause 2.4.9.

2.7 LOAD BREAK SWITCHES

2.7.1 General

2.7.1.1 The load break switches shall be fused type and generally conform to IEC-265 and the general requirements listed herein.

2.7.1.2 The load break switch shall be air break type suitable for indoor installation. It shall be triple pole and manually operated, the mechanism giving a quick make and break action. The poles shall be coupled to operate simultaneously. It shall be capable of being closed on a fault. The isolator gap shall be visible under all circumstances for safety reasons.

2.7.1.3 The load break switch including its operating mechanism, shall be so constructed that these cannot come out of their open or close positions by gravity, vibrations, reasonable shocks or accidental touching of the connecting rods or handle of the operating mechanism.

2.7.1.4 It shall permit locking in both the open and closed position. Mechanical indicators to show the positions shall be provided.

2.7.1.5 The load break switch shall be so designed that no dangerous leakage current can pass from terminal of one side to any of the terminal of the other side of the switch.

2.7.1.6 The frame of each load break switch shall be provided with a reliable earthing terminal and earthing connection to the earthing conductor as specified in clause 2.4.7. The diameter of the clamping screw shall be at least 12 mm and the connecting point shall be marked with the "Earth" symbol.

2.7.1.7 The load break switch shall be able to bear on the terminals, the total electrodynamics forces to which these may be subjected during short circuit operations without imparting its reliability or current carrying capacity.

2.7.1.8 For cable testing, testing plugs shall be provided. It shall normally be protected by a moveable shutter (cover).

The testing plug shutters shall only open, when the operating level of the isolator(s) is in OFF position and the isolator(s) shall not be ON until shutter is in close position.

2.7.1.9 The HRC power fuse shall be installed on the connecting blades of the load break switch. The fuse shall be refill type. The nominal current rating of the fuse shall be 200 amps. and interrupting capability (symmetrical) shall be 25 kA as applicable.

2.7.2 Ratings

2.7.2.1 The load break switch shall have following ratings;

		25 kA Panels
1.	Nominal voltage	11 kV
2.	Rated voltage	12 kV
3.	Rated current	200 Amps.
4.	Rated short time current (1 sec.) (r.m.s)	25 kA
5.	Rated short circuit making current (Peak)	63 kA
6.	Rated peak withstand current	63 kA
7.	Rated lightning impulse withstand voltage;	
	(i) Across isolating power	110 kV

(ii) To earth 95 kV

8. Rated One minute power frequency withstand voltage

(i) Across isolating gap 40 V

(ii) To earth 36 kV

2.7.3 Standard Tests

2.7.3.1 The load break switch shall be supplied in accordance with the requirements laid down herein and the IEC Publication-56. All tests shall be carried out in accordance with IEC-256 and as specified herein.

2.7.3.2 Routine Test

2.7.3.2.1 The following routine tests certificate of manufacturing company shall be provided by the contractor for each load break switch;

(i) Power frequency dry voltage test
(ii) Contact resistance test
(iii) Operation tests

2.7.4 Name Plate

2.7.4.1 The load break switch shall be provided with the name plate containing the information as given below. The name plate shall be visible in the position of normal service and installation.

(i) Manufacturer's name
(ii) Type and designation
(iii) Serial number
(iv) Rated voltage (kV)
(v) Rated lightening impulse withstand voltage (kV)
(vi) Rated normal current (A)
(vii) Rated one second short-time withstand current
(viii) Weight (kg)
(ix) Weight of oil (for oil type only)
(x) Year of manufacture

2.8 ENCLOSURE

2.8.1 General

2.8.1.1 The enclosure shall conform in general to clause 2.8.2 of IEC-298.

2.8.1.2 All live parts including bus bars, connections, circuit breakers, load break switches, voltages transformers, current transformers etc. shall be suitably

enclosed. The degree of protection shall be IP3X in accordance with IEC-298.

2.8.1.3 Access to parts such as bus bars, main connections, voltage transformers, current transformers and all other component of normal maintenance operation shall be through bolted plates or hinged doors with looking facilities as specified in clause 2.8.1.4.

2.8.1.4 The enclosure shall have a hinged door in the front and bolted plates at the rear. The instrument comportment door shall have proper sealing arrangement. All doors shall be provided with rubber gasket to minimize the dust entrance.

2.8.1.5 Four grouting holes of dia 14 mm shall be provided in the base plate of the panel.

2.8.1.6 Guide rails shall be provided at the base to ensure smooth entry of the breaker carriage into the panel.

2.8.1.7 An extension plate 600 mm x 900 mm x 2.3 mm shall be provided with guide rails from each row of wheels of the trolley. This shall have suitable arrangements for bolting on front of the panel so that the extension plate can be mounted flush with the floor on which the panel is installed.

2.8.1.8 Current and voltage transformers shall be located in a separate compartment having the provision for sealing independently.

2.8.2 Construction

2.8.2.1 The enclosure shall be made of high grade sheet steel of minimum thickness of 2.3 mm.

2.8.2.2 The enclosure shall be constructed so as to be rigid and self-supporting.

2.8.2.3 Suitable lifting eyes shall be provided for lifting the completed individual panel or switch by means of slings. The holes of the lifting eyes shall have minimum diameter of 45 mm.

2.8.3 Vermin Proofing

2.8.3.1 The enclosure shall be completely vermin proof with special regard to the danger of flashover, both in services and isolated positions.

2.8.4 Painting

2.8.4.1 All interior and exterior surfaces of the enclosure shall be thoroughly cleaned to prepare the metal surface for painting.

2.8.4.2 Three coats of paint shall be applied. The first coat shall be a primer of zinc chromate and iron oxide or any other primer which has equivalent weather resistance and rust inhibiting properties.

2.8.4.3 The second coat shall be based on synthetic resin with suitable properties for resistance to weathering.

2.8.4.4 The third finish coat shall also be based on a synthetic resin and shall have a hard durable surface and excellent weathering and fire resistant properties.

2.8.4.5 Alternative paint system having equivalent durability and resistance to weathering and fire may be allowed if approved. Full details shall be supplied for approval.

2.8.4.6 The total paint thickness shall be at least 0.08 mm on flat surface and 0.06 mm on curved surfaces. The panels shall be finished in light grey color equivalent to RAL 7032.

2.8.5 Circuit Labeling

2.8.5.1 A plain plastic sheet of black color shall be provided on each panel.

2.8.5.2 The size of sheet shall be 200 mm x 60 mm x 3 mm and it shall be screwed on the front of the enclosure.

2.8.6 Ventilating Openings, Vent Outlets

2.8.6.1 Ventilating opening and vent outlets shall be so arranged or shielded that a straight wire of any diameter cannot be brought into a position which would reduce the insulation level of the main circuits below the specified level. Such opening may make use of wire mesh or the like provided that it is of suitable mechanical strength.

2.8.6.2 Ventilating openings and vent outlets shall be arranged so as to minimize the danger to an operator due to gas or vapor escaping under pressure.

2.9 CURRENT TRANSFORMERS

2.9.1 Requirements

2.9.1.1 The current transformers shall be manufactured and tested in accordance with IEC-185 and particular requirements listed herein.

2.9.1.2 The current transformers shall be single pole, epoxy resin insulated, dry type, self-contained suitable for mounting in the switchgear panels.

2.9.1.3 The transformation ratio required for various types of switchgear of different ratings shall be as follows;

For Overcurrent Protection & Metering

(i) Incoming panel of 25 kA breaking 25/5/5A~250/5/5 amps. capacity

(ii) Outgoing panels of 25 kA rating 25/5/5A~250/5/5 amps.

2.9.1.4 The current transformers for the outgoing/consumer panels shall have two cores and each core shall be designed for protection and metering service and shall satisfy both requirements separately. Both the cores shall be identical.

2.9.2 Ratings

2.9.2.1 ***Protective Cores***

The cores meant for protective service shall have rated output of 15 VA and accuracy class 5 P20.

2.9.2.2 ***Metering Cores***

The CTs and cores meant for metering service shall have a rated output of 10 VA and accuracy class 1.0 in case of Outgoing etc.

2.9.2.3 ***Short Time Current Rating***

The rated short time thermal current ratings of current transformer shall be 25 kA for 25 kA Panels.

2.9.2.4 ***Dynamic Rating***

The rated dynamic peak current, which the current transformers shall withstand without being damaged electrically or mechanically, shall be 32 kA for 12.5 kA and 63 kA for 25 kA panels.

2.9.2.5 ***Insulation Levels***

The insulation level for the current transformers shall be as given below;

Rated Voltage	One Min. Power Frequency Withstand Voltage (r.m.s)		Rating Lightning Impulse Withstand Voltage (Peak)
12 kV	Primary -36 kV	Secondary 2 kV	95 kV

2.9.2.6 ***Temperature Rise***

The temperature rise of the CTs under conditions specified in clause 2.3.1 shall not be more than 40 °C. A reduction of 10 °C in the permissible value specified in IEC 185 has been made to account for high ambient temperature.

2.9.2.7 ***Terminal Markings***

The terminal marking for the current transformers shall be in accordance with IEC-185.

2.9.2.8 ***Rating Plate Markings***

The rating plate marking shall be as specified in IEC-185 and shall carry at least the following information in an indelible manner;

a) Manufacturers' name or trade mark
b) Serial number and type designation
c) Rated primary and secondary currents
d) Rated output and corresponding accuracy class for each core
e) Rated voltage
f) Rated frequency
g) Rated insulation level;
   (i) Lightning impulse withstand voltage
   (ii) One minute power frequency withstand voltage
h) Rated terminal and dynamic currents
i) Class of insulation

2.9.3 Tests

2.9.3.1 ***Routine Test***

The following routine tests certificate of manufacturing company shall be provided by the contractor in accordance with IEC Publication-185 for all the ratios and at all taps, if any;

(i) Verification of terminal markings
(ii) Power frequency test at primary windings
(iii) Power frequency test at secondary windings
(iv) Over-voltage interturn test
(v) Accuracy tests with 20% and 100% current for metering core only
(vi) Composite error, current and phase displacement measurements (for protection core only)

2.10 VOLTAGE TRANSFORMERS

2.10.1 General

2.11.1.1 The voltage transformers shall be self-contained, epoxy resin insulated, indoor type and shall be manufactured and tested in accordance with IEC Publication-186 and the requirements listed herein.

2.10.1.2 Voltage transformers shall be of three pole type of ratio 11,000/110 Volts or 3 single pole type of ratio $\sqrt{11,000}/\sqrt{110}$ Volts.

2.10.1.3 The rated frequency shall be 50 Hz and all rated outputs, accuracies and tests shall be for this rated frequency.

2.10.2 Ratings

2.10.2.1 The standard ratings of the voltage transformer shall be as under;

(i)	Nominal system voltage	11 kV
(ii)	Rated secondary voltage	110 V
(iii)	Rated frequency	50 Hz
(iv)	Rated secondary output at 0.8 P.F lagging	100 VA per phase
(v)	Standard accuracy class	0.5
(vi)	Rated one minute power frequency withstand voltage (r.m.s)	
	a) Primary	36 kV
	b) Secondary	2 kV
(vii)	Rated lightning impulse withstand voltage (peak)	95 kV

2.10.2.2 Rated Voltage Factor

The standard value of rated voltage factor shall be 1.2 for continuous duty and 1.5 for 30 seconds duration.

2.10.3 Temperature Rise

The temperature rise of the voltage transformer under conditions specified in clause 2.3.1 shall not be more than 40 °C. A reduction of 10 °C in the permissible value specified in IEC-186 has been made to account for high ambient temperature.

2.10.4 Short Circuit Characteristics

Voltage transformer shall be capable of withstanding for 1 second the mechanical and thermal stresses resulting from short circuit on secondary terminals with full voltage maintained on the primary terminals.

2.10.5 Terminal Marking

The terminal markings shall be in accordance with IEC-186.

2.10.6 Rating Plate

A rating plate shall be attached above the terminal box or to an alternate location if the alternate location is more readily accessible when the transformer is mounted. The name plate shall include as minimum the following information in an indelible manner;

(i) The manufacturer's name or trade mark
(ii) Serial number and type designation
(iii) Rated primary and secondary voltage
(iv) Rated frequency
(v) Rate output and the accuracy class
(vi) Class of insulation
  a. Lightning impulse voltage withstand voltage
  b. One minute power frequency withstand voltage
(vii) Connection diagram and polarity marking
(viii) Rated voltage factor and corresponding rated time

2.10.7 Tests

The following routine tests certificate of manufacturing company shall be provided by the contractor in accordance with IEC-186. The routines tests to be performed are listed below;

(i) Verification of terminal marking
(ii) Power frequency tests on primary windings
(iii) Power frequency tests on secondary windings
(iv) Determination of errors according to the requirements of the accuracy class

2.11 CONTROL WIRING AND TERMINATION

2.11.1 Control cable and wiring shall conform to WAPDA/PEPCO/HESCO specification P-100. Voltage circuit shall be made with 2.5 mm^2 cable and current circuit with 4 mm^2 cable. All control wiring shall run through channels with removable covers provide easy access for inspection and replacement.

2.11.2 The ends of each wire shall be identified by machine-lettered permanent fiber or plastic identification ferrules.

2.11.3 Each panel shall be supplied with necessary length of control wiring required for interconnection complete with termination.

2.11.4 Termination

2.11.4.1 Each conductor of control wiring shall be terminated at each end in a terminal block with either a pressure connector or spade type terminal. The terminals shall be tinned copper and may be crimped or compression applied. Each terminal block shall be provided with a slip-on cover to avoid any accidental touch.

2.11.4.2 Each terminal block shall have an individual color coded marking strip which shall be machine-lettered or engraved with the circuit designation of

the terminals. One spare marking strip shall be provided for each terminal block.

2.11.4.3 In case of hinged panels, matching terminal blocks shall be provided on both sides of the hinged section.

2.12 INSTRUMENTS

2.12.1 General

2.13.1.1 The instruments shall be manufactured and tested in accordance with International Electrotechnical Commission Publication-51 and the requirements listed herein.

2.12.2 Constructional Requirements

2.12.2.1 The indicating instruments shall be semi-flush mounted, back connected, dust proof switchboard type having a removable transparent dust tight window cover with a dull black finish to match in appearance with relays and meters and having facility to change the scale with or without opening the instrument. The normal size of instrument unless otherwise specified shall be 96 mm x 96 mm. Scale plates shall be a permanent white instrument transformer ratio for which instrument has been graduated prominently marked. The zero adjuster will be provided outside the instrument. All instruments shall be tropicalized.

2.12.2.2 Ammeters shall be suitable and robust enough to withstand the momentary high current rising in the circuits during short circuit conditions without damage or loss of accuracy.

2.12.2.3 Terminal Markings

The marking of terminals of instruments intended for use with instrument transformers should preferably be the same as those of the terminal of the instrument transformer in which they are to be connected.

2.12.2.4 Diagram of Connection

A diagram of connection giving the following particulars shall be supplied with the instrument;

(i) The corrected disposition of the connections carrying current to and from the instrument

(ii) Diagram explaining internal working of the instrument

2.12.2.5 Damping of Instrument

The suspension of the moving part shall be taut band type. The damping of the instruments shall comply with clause-8.1 of IEC Publication-51.

2.12.2.6 ***Continuous Load and Overload Capability***

2.12.2.6.1 All measurements together with their accessories, shall comply with the requirements appropriate to their accuracy class when they are continuously loaded at their upper measuring limit under the reference conditions specified in table-III and IV of IEC Publication-51.

2.12.2.6.2 The continuous overloads which the instruments along with their accessories, shall be able to withstand without damage shall be in accordance with clause 8.3 of IEC Publication-51.

2.12.3 Accuracy Class

The accuracy of instruments shall be of class 2.5 for ammeters, voltmeters and power factor meters in accordance with IEC-51.

2.12.4 Scale Ranges

2.12.4.1 Ammeters

The preferred full scale values of ammeter for use with current transformers shall be as follows;

Rated Primary Current of CT	Full Scale Value
50	60
100	120
200	250
400	500
800	1000
1600	2000

2.12.4.2 Voltmeters

The preferred full scale values of voltmeters shall be as follows;

Nominal System Voltage	Full Scale Value
11 kV	15 kV

2.12.4.3 Scale Marking

For the instruments which are used in conjunction with current transformers, the number of scales shall be in accordance with the number of CT ratio available on the connected current transformers, there being a separate scale plate for each ratio. The scales can be on both sides of the scale plate and the required number of scale plate shall be fixed on the

instruments so that after changing the CT ratio, the corresponding scale plate of the instrument could also be changed. The scale plates shall clearly define the corresponding CT ratio and the CT ratio wording shall be prominently marked on the dial plate. The scale marking shall be evenly distributed between 10% and 100% percent of the scale range.

2.12.4.5 ***Marking and Symbols***

Marking and symbols of instrument transformers shall be in accordance with clause 10.1 of IEC Publication-51. The applicable markings and symbols as per clause 10.1 of IEC Publication-51 shall also be provided, whenever possible.

2.12.4.6 ***Name Plate Data***

A name plate showing the following shall be attached with the instrument;

(i) Rated values
(ii) Specification number
(iii) Manufacturer's name with counter of origin and year of manufacture
(iv) Percentage error

2.13 RATING PLATES

2.13.1 The rating plate for each complete panel shall be fixed on front side of the enclosure. The plate shall be marked with the following information;

(i) Manufacturer's name or trade mark
(ii) Type designation
(iii) Reference standard
(iv) Insulation level
    a. Lightning impulse withstand voltage
    b. Power frequency withstand voltage
(v) Voltage rating
(vi) Current rating of the breaker
    a. Continuous
    b. Short-time
(vii) Rated current for bus bars
(viii) Breaking capacity, 25 kA as the case may be
(ix) Current transformation ratio of the CTs installed;
    a. Metering
    b. Protection
(x) Voltage ratio of voltage transformers where applicable
(xi) Frequency in Hz
(xii) The rated operating voltage or currents of the trip coil as the case may be
(xiii) Diagram connections

(xiv) Weight
   a. Circuit breaker trolley
   b. Total
(xv) MUET contract number and date
(xvi) Reference of operating instruction book
(xvii) Reference circuit connection schematic and wiring diagrams

2.13.2 The rating plates for Load Break Switches (clause 2.7), instrument transformers (2.9.2.8 and 2.10.6), and instruments (clause 2.12) shall be fixed as specified in the respective clauses.

2.13.3 Operating Instruction Plate

2.13.3.1 An instruction plate showing all necessary steps to be followed in the required sequence of operations for withdrawing, in section, engaging and operation for the guidance of the operator.

2.13.3.2 The instruction plate shall be made of durable material and so placed that it immediately catches the eyes of the operator when he intends to perform any operation.

2.15 TESTS ON PANELS

2.15.1 The components formic part of metal enclosed switchgear shall comply with and be tested according to the tests specified in the relevant clauses of the specifications.

2.15.2 Routine Tests

2.15.2.1 The following routine tests certificate of manufacturing company shall be provided by the contractor on all transportable assemblies at the manufacturer's works;

(i) Power frequency Voltage tests on the main circuit IEC Publication-298, sub-clause 7.1
(ii) Dielectric tests on auxiliary and control circuits, IEC Publication-298 sub-clause 7.2
(iii) Measurement of the resistance of the main circuit, IEC Publication-298 sub-clause 7.3
(iv) Mechanical operation tests, IEC Publication-298 sub-clause 7.101
(v) Tests of auxiliary electrical devices, IEC Publication-298 sub-clause 7.102
(vi) Verification of the correct wiring IEC Publication-298 sub-clause 7.103
(vii) Verification of the interchangeability of components of the same rating and construction

(viii) Measurement of electrical resistivity of bus bar copper, IEC Publication-468

(ix) Visual inspection and checking of dimensions and other constructional details to verify their conformance to the approved drawings and interchangeability requirements specified in clause 2.4.1.11

2.16 FOUNDATION

2.16.1 The manufacturer shall supply foundation plan and all the necessary material such as foundation bolts, guide rails, extension plate etc. for mounting the panel on the floor.

2.16.2 The switchgear panels shall be installed away from the switch room wall in front of a cable trench of width between 800 mm and 1500 mm with reasonable overhang on the cable trench if necessary.

2.17 DRAWINGS AND DESCRIPTIVE DATA

2.17.1 Bid Drawings

2.17.1.1 The following data drawings, information and descriptive data shall be supplied with each bid. Failure to supply this data or part of it will result in offer being declared non-responsive.

2.17.1.2 Complete Panel

(i) Overall assembly drawing showing front, back side and plan views with doors closed and open. Sufficient cross sections and part views shall be indicated to clearly show all the equipment. All leading dimensions and clearances in millimeters shall also be indicated

(ii) Wiring and schematic diagram showing also the types of the components

(iii) Details of paint system

(iv) Drawing and characteristics of insulators

(v) Details of earthing arrangements as;

Arrangement shall be provided so that earthing for safety can be installed while carrying out maintenance for the incoming/outgoing circuits. Detail of these arrangements shall be provided with the offer.

2.17.1.3 Bus Bars

(i) Drawing showing the material, size of bus bars, the details and method of jointing and mounting on insulators

(ii) The details of electrical and mechanical characteristics of insulators

(iii) Current rating and temperature rise of bus bars

(iv) Details of insulation used, including type of clearances
(v) Details of tinning at bus bar joints

2.17.1.4 Current Transformers

(i) Sketches showing outline, weight, dimensions, name plates, location and accessories and the locations and connections of transformer in the arrangement scheme
(ii) Overall assembly drawing front, side and plan view and details of mounting and terminals
(iii) Typical current errors and phase displacement curves for the standard burdens from 0 to 2 times rated secondary current for metering current transformers
(iv) Typical composite error curves from 0 to 20 times rated secondary current for protective current transformers
(v) Short-time thermal current, continuous thermal current, dynamic current ratings and the insulation level
(vi) Typical excitation curves for protective transformers up to 20 times the secondary rated current
(vii) Resistance of the secondary winding for protective current transformers
(viii) The maximum guaranteed instrument security factor for metering current transformers

2.17.1.5 Voltage Transformer

(i) Sketches showing outline, weight, dimensions, name plate, location of accessories and the location and connections of voltage transformers in the arrangement scheme
(ii) The supplier shall furnish typical ratios and phase angle curves for the standard burdens for easy type voltage transformer. Also shall be supplied curves for voltage transformer accuracy plotted for the power factor of the standard burdens and for 100% power factor from zero to maximum accuracy rating of the transformer
(iii) Overall assembly drawing showing front, side and plan views

2.17.1.6 Load Break Switches

(i) Outline drawings, descriptive literature and sketches to describe clearly the construction and operation of the load break switch. Detail of contacts
(ii) The descriptive data should be sufficient detailed to evaluate clearly the quality of the switches
(iii) The type test certificates as required in IEC-265
(iv) Details of interlocking arrangement

2.17.1.7 ***Instruments and Meters***

(i) Outline drawing and the accuracy data on each type of instrument and meter to be supplied

(ii) The technical data of meters as required in WAPDA/PEPCO/HESCO specification P-42 and P-97 to fully evaluate the performance of the meters

2.17.1.8 ***Control Wiring and Termination***

(i) Catalogue and descriptive data giving necessary details and sizes of the wire and cable used

(ii) The method of installation and termination

2.17.2 Approval Drawings

2.17.2.1 The supplier/manufacturer shall be required to supply information and drawings for approval after the issue of letter of intent or the purchase order as mentioned below.

2.17.2.2 ***Complete Panel***

(i) Complete wiring and schematic diagram showing the types of the equipment

(ii) Overall assembly drawing showing from, side and plan view with doors closed and open. Sufficient cross-sections and part views shall be included to clearly indicate all the equipment. All leading dimensions and clearances in millimeters shall be indicated

2.17.2.3 ***Enclosure***

(i) Detailed fully dimensioned drawings showing the enclosure alone. The sizes, and lengths of all sheet angles, and shapes to be shown

(ii) Detailed dimensioned drawings for the design of doors, lifting eyes, hinges, locking and scaling facilities and handles

2.17.2.4 ***Bus Bars***

(i) Drawing showing size (mm) of bus bars, details and methods of jointing and mounting on insulators

(ii) The bus bar insulator drawing

2.17.2.5 ***Current Transformers***

The drawings shall include all the data requested in clause 2.17.1.4 and detailed dimensioned drawing of mounting and terminals.

2.17.2.6 ***Voltage Transformers***

(i) The drawing showing outline, mounting and primary connection of the voltage transformer. This should include the data requested in clause 2.17.1.5

(ii) Detailed schematic diagrams showing primary and secondary connections of all instrument transformer circuits

2.17.2.7 ***Load Break Switches***

The drawing showing detailed physical arrangements and connection of the load break switch indicating also the necessary data of the load break switch in accordance with the clause 2.7.2.

2.17.2.8 ***Instruments and Meters***

The drawings showing the size, scale marking, detailed description, engineering application data and connection diagrams for each type of instrument and meter including information required in clause 2.17.1.7.

2.17.2.9 ***Control wiring and Terminations***

The drawings showing details of quality and sizes, including supports and terminations of control cables. The wiring diagrams shall also indicate colour of wires.

2.17.2.10 ***Instructions for Transport, Storage, Erection and Maintenance***

Detailed instruction book for the transport, storage, erection, operation and maintenance in service of the switchgear shall be furnished by the supplier/manufacturer for breakers as specified in IEC-694 clause 10 and IEC-56-6, sector-II. This information should cover instructions on transport, storage, erection of the circuit breaker and complete switchgear including unpacking, lifting, assembly, mounting, connections final installation inspection and tests. Instructions should also be furnished for maintenance and adjustment and attention to special parts such as bearings, pneumatic and hydraulic system, lubrication greasing and cleaning etc. which require regular attention. This information should include the number of operations after which overhaul becomes necessary under normal service conditions. In addition correct sampling procedure for sampling oil shall be provided.

2.18 PACKING AND TRANSPORTATION

2.18.1 In case of supply originating within Pakistan, the packing should be suitable for transportation by rail/road. The packing should also provide protection from damage due to rain.

2.18.2 For supplies originating in countries other than Pakistan, the packing should be suitable for transportation by sea and should provide protection for damage due to exposure to the weather in open storage for period extending to about one year. Packing should provide protection against damage in transit, corrosion and fungus growth. The method of packing should be suitable for sea shipment and not excess of available handling facilities. All boxes in excess of 500 kg should be adequately marked for stringing and lifting whenever necessary. The boxes should be provided for lifting hooks attached by means of vertical rods or plates to string bottom supports.

3. TRANSFORMERS

REFERENCE SPECIFICATIONS

The transformers shall be supplied and tested in accordance with the following international Electro-technical Commission (IEC) Specifications (amended to date):

a.	IEC Publication 60076	Power Transformer (Part 1-5)
b.	IEC Publication 60137	Bushings
c.	IEC Publication 60296 & 60422	Transformer Oil
d.	IEC Publication 60060	High Voltage Test techniques
e.	ANSI / IEEE Spec C57.91	
f.	ANSI / IEEE Spec C57.12.00	
g.	ANSI / IEEE Spec C57.12.9	

3.1 SCOPE

This Standard covers the requirements of 3-phase, hermetically sealed distribution transformers, having winding, insulated with Class-A insulating material, and rating 500 kVA.

3.2 DEFINATIONS

3.2.1 The IEC relevant definition shall apply.

3.2.2 **Independent Laboratory**

An internationally accredited independent lab, for the specified requirement of type test and type reports by an independent Authority / Independent Lab. The following will be considered as internationally accredited Independent labs;

(a) KEMA Lab Holland
(b) CESI Lab Italy
(c) CRIEPI Lab Japan
(d) HV&SC Testing Lab. Raw at Pakistan

(e) Any other laboratory accredited by EA (European Corporation for accreditation or a member thereof)

(f) Any other laboratory accredited by ILAC (International Lab Accreditation Corporation or a member thereof)

(g) Any other Laboratory accredited by IAF (International Accreditation Forum or a member thereof)

(h) Any other laboratory accredited by STL (Short Circuit Testing Liaison or a member thereof)

3.3 SERVICE CONDITIONS

3.3.1 Transformer rated in accordance with this standard shall be suitable for operation under service conditions set out in clauses 3.3.2 & 3.3.3

3.3.2 **Reference Ambient Temperatures**

The Reference Ambient Temperatures assured for the purpose of this standard are;

(i) Maximum ambient air temperature 50 ^{0}C.

(ii) Maximum daily average ambient air temperature 40^{0}C.

(iii) Maximum yearly average ambient air temperature 30^{0} C.

3.3.3 **Altitude**

The altitude will not exceed 1000 meters (3,300 feet)

3.4 RATING

3.4.1 The manufacture shall describe ratings to the transformer which shall be marked on the rating plate (see Section 3.12), These ratings shall be such that the transformer can deliver its rated current under steady loading conditions without exceeding the limits of temperature rise specified in Section (3.9) assuming an applied voltage equal to the rated input voltage and that the supply is at 50 cycles per second at the principal tapping. The output voltage and current shall be of approximately sine-wave form.

3.4.2 The preferred values of rated power for 3 phase transformer are: 500 kVA.

3.5 MEHTOD OF COOLING

The method of cooling will be natural air, the method of circulation of oil will be by natural thermal head and would be indicated by symbol "ONAN".

3.6 REGULATING TAPS

3.6.1 Unless otherwise specified tap shall be -2.5%, -5% and -7.5% for 500 kVA transformers. The tapping being located on the higher voltage winding.

3.6.2 Tap-changing shall be affected by means of an externally operated off circuit switch capable of being locked in position. It shall be accessible with safety.

3.6.3 The tap-changing contacts shall be capable of carrying the same currents, due to external short circuits, as the windings into section (3.10).

3.6.4 When tapping is used to compensate for variation of voltage, the transformer shall be capable of operation at its rated kVA on any tapping without injury.

3.7 INSULATING MATERIAL

The thermal class of insulating material class A is recognized. Low viscosity insulating oil conforming to IEC-60296 & 60422 (amended to-date) shall be used.

3.8 INSULATION LEVEL

3.8.1 Test voltage shall be based on the system highest voltage of which the transformer forms a part. This value for nominal voltage of 11 kV is 12 kV.

3.8.2 Power frequency test voltage will be 34 kV and the impulse test voltage to be 95 kV. The wave being 1/50 µsec.

3.8.3 Insulation to Earth

The insulation to earth of windings will be uniform.

3.9 LIMITS OF TEMPERATURE RISE

3.9.1 When transformers are tested in accordance with the temperature rises above ambient of the winding, cores, and oil shall not go beyond the limits specified below;

Winding	50°C	
Oil	40°C	
Core	On external surface at the point	Winding for Tabular Tank
Winding	49°C	For corrugated fin Tank
Oil	38°C	For corrugated fin Tank

Note:

"The hottest spot temperature rise for 65°C average temperature rise ratings shall not exceed 80°C Temperature rise ratings to be based on average 24-hour ambient temperature of 30°C, and maximum ambient temperature of 40°C in accordance with ANSI / IEEE C 57.91".

3.10 SHORT CIRCUIT WITH STAND

3.10.1 General

The transformer shall be designed and constructed to with stand without damage, the effects of short circuit of magnitude equal to 25 times the symmetrical r.m.s. values of valid current for 2 seconds.

3.10.2 Mechanical Requirements

The transformer shall be cable of withstanding, without damage on any tapping, under service conditions, the electromagnetic forces arising under short circuit conditions as determined from the systematical peak value of the current in the windings which shall be taken as not greater than 2.55 ($1.8 \times \sqrt{2}$) time the over current derived.

Note: In the case of a transformer where the value of resistance relative to that of reactance is significant, figures lower than 2.55 may be more realistic.

3.10.3 Thermal Requirements

The transformer shall be capable of withstanding, without damage on any tapping under service conditions the thermal effects of short circuit at the terminals of any windings, for 2 seconds.

3.10.4 Short circuit tests are not included as a standard requirement of these recommendations. To verify the ability of the transformer to with stand the mechanical and thermal stresses arising under short circuit conditions, the first transformer of a new design (prototype) shall be subjected to dynamic laboratory. Certificates from an internationally accredited independent laboratory, as proof of having carried out the test on the prototype of exactly same rating and design will be acceptable

3.11 MARKING AND MARKING PLATES

3.11.1 Designating Letters

Letters shall be assigned to phase windings. The same letters shall be used for all windings on the limb of the core.

The higher voltage windings shall be described by a capital (or Black) letter and the lower voltage winding of the same phase by the corresponding small **A B C** for higher voltage and **a b c** for lower voltage windings. See fig. (1)

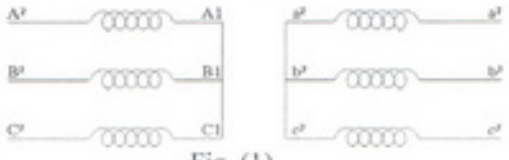


Fig. (1)

When a phase winding is divided into sections, the subscript numbers to the ends and tapping of the windings shall be as per fig. (2)

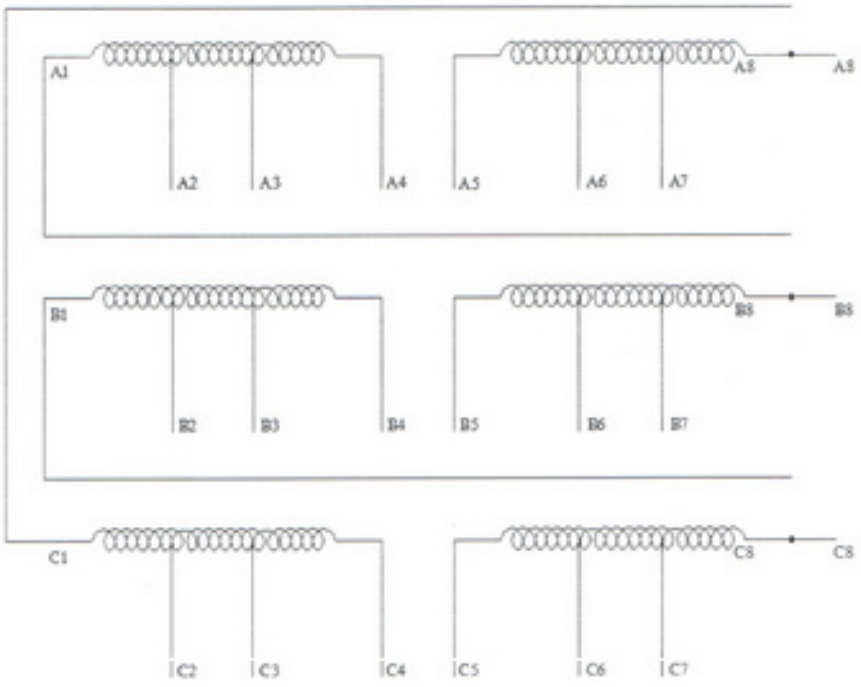


Fig. (2)

Three phase windings with tapping at middle. Typical designating letters and subscript numbers for tapped windings showing also terminal connections.

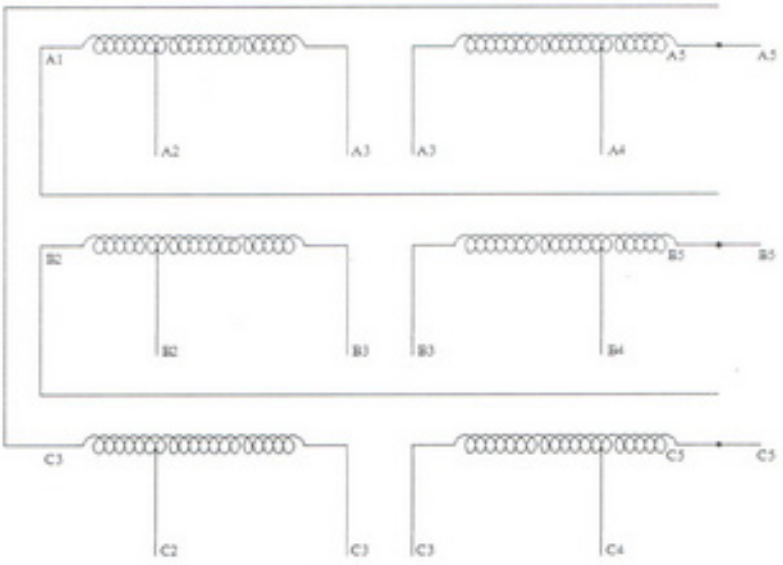


Fig. (3)

3.11.2 Terminal and Sub Terminal Marking for Transformers

The appropriate designating letter and subscript numbers assigned to the windings and tapping shall be clearly and indelibly marked upon, or adjacent to the terminals and sub terminals with which they are associated.

(a) The marking for line terminals of transformers, both letter and subscript shall be the same as those of the phase winding to which the line terminal is connected as in fig.2. When the terminal is connected to more than one sub terminal as in the case of a delta connection, the marking selected shall be shown on the relevant diagram.

(b) Neutral terminal to be marked.

n (Without a subscript number)

3.11.3 Position of Terminals

3.11.3.1 General

Viewed from the higher voltage side arrangement for both sets of terminals shall be alphabetical from left to right for the phase terminals. Where a neutral terminal is fitted, it shall be on the extreme left. (See fig-4)

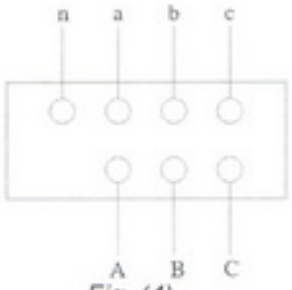


Fig. (4)

Marking and relative position of terminals

3.11.4 Vector Diagram and symbols

3.11.4.1 Reference to vector diagrams shall apply to diagrams below. The vector group symbol being DY-11 belonging to group with phase displacement of minus 30^{o}.

Line Terminal markings and Vector diagram of induced voltages

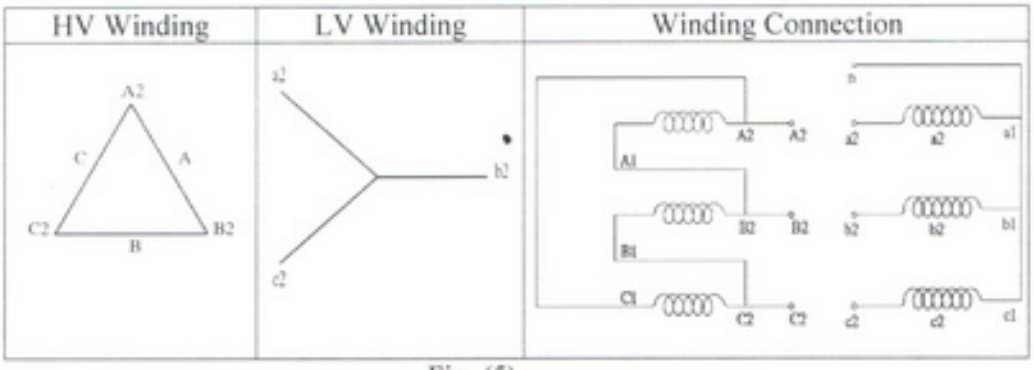


Fig. (5)

3.12 RATING PLATES

3.12.1 (a) A plate shall be provided showing the relative physical position of the terminal, their markings and the approximate position of one external fitting.

Plate shall show the relative position number of tap connection corresponding to the different voltages. The switch position corresponding to the maximum number of turns in the tapped winding shall be position 1.

The rating plate shall include the manufacture's diagram of connections.

(b) Arrangements of information. The general arrangement of rating plates shall be as given below;

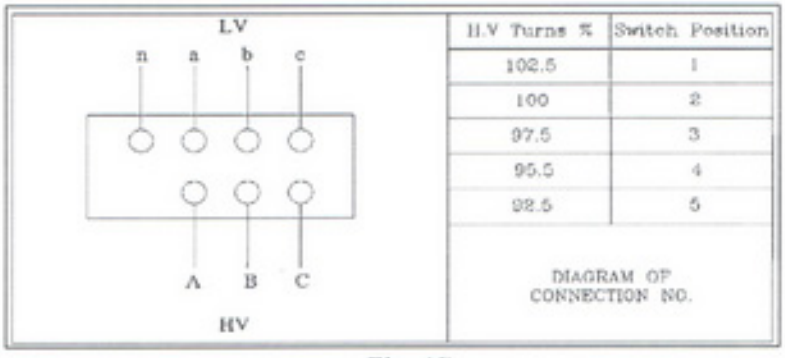


Fig. (6)

3.12.2 **(a) Information to be given on rating plates**

All transformers shall be fitted with rating plates giving the information detailed in items 1 to 17 below;

(i) The number of this standard

(ii) Manufacturer's name

(iii) Manufacture's serial number

(iv) Rated kVA

(v) Number of phases
(vi) Frequency
(vii) Rated voltage at no-load (Higher-voltage/Lower voltage)
(viii) Rated current higher voltage / Lower voltage
(ix) Impedance (%age)
(x) Winding Connections and phase displacement symbols of vector diagram
(xi) Connection Diagram.
(xii) Weight of Complete transformer In kg.
(xiii) Type of cooling
(xiv) Total weight of Oil in Kg
(xv) Weight of core and windings assembly in kg
(xvi) Year of manufacturing
(xvii) The word "HESCO" and purchase order number

(b) Arrangements of Information

The arrangement of the information given on the rating plate shall be as below;

	kVA: _____	Type of Cooling:	_____
	Volts: _____		
	HV: _____	Frequency:	_____
	LV: _____	Impedance %age:	_____
No Load Amperes	HV: _____	Weight of Oil:	_____
	LV: _____		
Phases	HV: _____	Weight of Core & Winding:	_____
	LV: _____	Total Weight:	_____
Diagram DRG. No.:	_____	Year of Manufacture:	_____
Vector Symbols:	_____	Maker's Serial No.:	_____
		MUET L.O.A. No. & Date:	

3.13 PROVISION OF FITTINGS

3.13.1 Fitting for transformer shall be as specified below:

	Items	Application
(a)	Rating Plate	All transformers
(b)	P.O. No. punch	All Transformers

On base Channel.

(c)	Lifting Lugs	All transformers
(d)	Earthing terminal for tanks	All Transformers
(e)	Oil filing hole and plug	All Transformers
(g)	Drain plug with sampler	
(h)	Support Lugs	

3.14 SPECIAL REQUIREMENTS

3.14.1 The manufactures must be ISO 9001:2001 Certified.

3.14.2 **Tank with Top Cover**

500 kVA transformer shall be of hermetically sealed tank construction with air cushion with bolted cover and shall be suitable for outdoor pole/Pad mounting Installation.

3.14.3 Transformer of sealed tank construction shall be effectively sealed from atmosphere for a top Oil temperature range of 0 ^{0}C to 110^{0}C.

(i) The completely assembled tube tank transformers having air cushioned shall be designed & tested to withstand without deformation or leakage an over pressure of 15 lbs/in^2 for 15 minutes.

(ii) The Completely assembled corrugated fin type transformer with air cushioned shall be designed and tested without deformation or leakage an over pressure of 30 KN/m^2 or 5 lbs/in^2 for minutes.

(iii) Dry Nitrogen gas shall be used for over pressure test to avoid moisture entry.

(iv) Oil level indicator shall be located on top cover or on the side wall of the transformer with marking of min. & max. level of oil in transformer.

3.14.4 **Tank Construction (Tubular / Corrugation fins)**

Any of the following types will be acceptable;

(a) Tubular Tank

The transformer shall be tube type tank construction with bolted Cover. The sheet thickness shall be 3.0 mm (min). The top cover sheet thickness shall be 6 mm. alternatively; 4 mm sheet can be used after reinforcement & creating stiffness by bending all sides. The thickness of bottom sheet shall be 4 mm (min). A metallic strip of MS sheet of appropriate size shall be provided round the tubes of the tank for extra protection of all the transformers.

(b) ***Corrugated Fin Tank***

The transformer shall be corrugated fin type tank construction with bolted cover. The frame (upper & lower) sheet thickness shall be 3.0 mm (min). The fin sheet thickness shall be 1.2mm with mill variation. The top cover shall be the same as described in "tubular tank" clause 3.14.4(a). A metallic rod of MS of 6mm dia minimum shall be provided on the upper & lower corners of the each fin panel for making it straight & aligned.

3.14.5 Bird Protection

To prevent flashover caused by large birds, transformers cover shall be effectively coated with a weather proof permanent insulating material / powder coating having a dry dielectric withstand voltage of not less than 8 kV to withstand 8 kV dielectric test.

3.14.6 Tank Finish

The tank finish shall be a Battle-ship gray color. The paint shall be corrosion resistant, capable of meeting or exceeding requirement under ANSIC 57.18.28 highly resistant to the effects of strong sunlight and high temperature and shall have a long life under such conditions. Before paint, the outside surface of tubular tank / corrugated tank shall be properly prepared by shot blasting / sand blasting respectively. The thickness of paint coating shall not be less than 0.12 mm.

3.14.7 Bushings

Bushings and Connectors shall be provided on transformers as per WAPDA/PEPCO/HESCO standard designs.

3.14.8 Transformer Oil

(a) The Oil used in the transformers shall conform to IEC-60296 & 60422, Class-1 Oil (amended to date)

(b) To avoid formations of bubbles and entry of moisture to ensure longer service life, it is essentially required to fill transformer oil under vacuum

(c) Oil testing facilities such as oxidation stability, dissipation factor, pour point etc. Shall be arranged in the manufacture's lab

(d) If the type testing facilities of the Oil is not available at the works of the manufacturer, the oil will be got tested at any internationally accredited independent lab. And the delay in delivery period will be to the manufactures account

(e) All the necessary documents for the purchase of oil should also be submitted to WAPDA/PEPCO/HESCO design and standard and material inspection department

3.14.9 The kVA rating of the transformers shall be stenciled in white on both sides of the transformers in 4 inches bold letters as per WAPDA/PEPCO/HESCO standard designs.

- Lifting Lug
- Filling Plug & Collar
- Mounting Arrangement for Distribution transformers

3.15

3.15.1 **Special Technical Conditions**

The transformer shall conform to WAPDA/PEPCO/HESCO specification No. DDS-84:2007 (amended to date), P-10:67 (amended to date) and IEC Standard for short circuit with stand test as per their publication: 76-5 (amended to date). 500 kVA rating transformers shall be duly fitted with wheels.

3.15.2 **Core Material**

a. The core shall be of high grade non ageing prime CRGO Electrical steel sheet at least M4 grade or equivalent.
b. It should be from Western Europe, North America, Japanese, Australia, and New Zealand.
c. Manufacturer must develop the testing facilities for testing of core material or it may be got tested at any internationally accredited independent lab at the expenses of the manufacturer.
d. A certificate showing the test results from the core manufacturers for authenticity of the quality of the core shall be provided
e. The record of import for the purchase of the core from the foreign manufacturers will also be supplied

3.15.3 **Prevention of Moisture Entry**

The manufacture must design their transformer to prevent the Moisture Entry as follows:

(a) Gasket

- NBR rubber seal (double) with a metal seat on the spindle of tap Changer driving rod to hold the NBR rubber must be provided. NBR must Conform to ASTM F-104 (amended to date) with the following properties;

(i)	Change in mass	(+ 15%, -5%)
(ii)	Hardness	(60 – 90)
(iii)	Compressibility	(25% - 35%)

- Gasket of NBR (Nitrile Butadiene Rubber) NBR rubberized cork sheet conforming to ASTM F-104 (amended to date) be provide under the cover plate of the transformer and HT & LT bushings. A certificate from the Gasket manufacturer for authenticity of quality of NBR shall be provided for each lot of the offered transformers.

(b) ***Nuts & Bolts***

(i) High tensile galvanized steel bolts, alternatively with galvanized M.S bolts conforming WAPDA Specification P-82 clause 3.2.2 for zinc coating and clause 8.8 of DIN 627 for hardness be provided for achieving proper tightness of transformer cover plates

(ii) All Nuts and Bolts used for Tank Assembly Shall be hot dipped galvanized according to Specification P-82 (attached) having the Weight of Zinc coating as under;

— Individual 305 gram / m^2

— Average (3 samples) 380 gram / m^2

(c) Araldite/Epoxy applied on portion of screws of upper arcing horn before tightening

(d) ***Electro Galvanizing of Steel Parts***

On both ends of the Tie Rods, Hanging studs & Core Bolts, Lock Nuts with spring/lock Washers are to be used. All threads of Tie Rods, Hanging studs & Core Bolts be punched after proper tight. All steel washers, nuts, tie rods shall be electro galvanized.

(e) Check nut should be used on HT through bolt under the HT connectors.

(f) The top end of HT Bushing shall be filled with Araldite 2 to 3 inches after fitting of through bolts so that moisture/Water should bolt enter from the outside. A space of 50 to 75 mm of the insulation tube at the bottom may be kept empty. Alternatively long Casted bolt bushings or Elastimould Bushings may be used.

(g) Industrial sealant shall be applied on the side wall oil gauge in case of non-rubber gaskets.

(h) The holes of HT/LT bushings on the top cover sheet of the Transformers should be pressed upward.

3.15.4 *a) HT/LT Connectors*

HT/LT connectors shall be tested during stage inspection according to specification P-72 (amended to date) attached. The material of HT/LT connectors shall be of brass with minimum tin coating of 30 microns conforming to BS 1872:84

b) LOCKING Arrangements

Locking arrangements be provided to HT & LT connectors by welding / press fitting of metallic washer of brass at end of bolt.

c) Insulating Material

Pressboard, pressure blocks, winding Coil drums, oil duct strips and separator shall be used either made of press board or Laminated Wood / Bakelite Blocks Conforming to International Standards.

d) Conductor Risers

Flexible Conductor risers connecting LT Windings to transformer terminals must be electrical grade.

e) Earthing Terminal

The dia of hole for earthing terminal shall be 12 mm.

f) Sealing of Oil Filling Plug

The arrangement of sealing of Oil filling plug shall be provided.

g) Sealing Arrangement of Transformer

Two through hole Bolts shall be provided on the adjacent sides of the top cover to seal the transformer.

h.) Hanging Rods

The lifting rods, Yoke Clamping bolts and tie rods shall be of appropriate size to sustain forces during short circuit.

3.15.5 **Core & Winding Losses**

The maximum allowable losses at rated voltage and rated frequency permitted for 11/0.415 kV distribution transformers as per WAPDA/PEPCO/HECO standard design specifications (updated).

The losses shall be maximum allowable as per WAPDA/PEPCO/HECO standard design specifications (updated) and there would be no positive tolerance. Transformer with higher losses than any of those specified values would be unacceptable.

3.15.6 **Dimensional Checks**

02 Nos. transformers of each rating from each Lot will be selected and opened from the offered transformers by Inspectors for individual check,

one transformer in the beginning and other at any stage and internal details will be compared with approved drawings.

3.15.7 Transformer Oil Test

The oil shall conform to IEC-60296 & 60422 (amended to date) clause-l Oil;

Routine Tests

The following routine tests certificate of manufacturing company shall be provided by the contractor as per IEC-60296 & 60422 (amended to date) at manufacturer's lab:

(a) Specific gravity of the oil
(b) Viscosity
(c) Flash point
(d) Acidity Value
(e) Dielectric Strength of the Oil
(f) Pour point

3.15.8 Temperature Rise Test

The test certificate of manufacturing company shall be provided by the contractor for the Temperature Rise Test by feeding the declared guaranteed losses at the principal tap once during the financial year.

3.15.9 Short Circuit Test

The test certificate of manufacturing company shall be provided by the contractor for short circuit withstand.

3.15.10 Impulse Voltage withstand Test

The test certificate of manufacturing company shall be provided by the contractor for the Impulse Voltage withstand as per IEC 76-3 (amended to date) and P-10:67 (amended to date) on each phase of the transformer with following sequence;

Step 01	Reference Wave (60 kV)
Step 02	Full wave (95 kV)
Step 03 & 04	Two Nos. Chopped Waves (110 kV)
Step 05	Two No. Full Wave (95 kV)

The test Voltage shall be of Negative polarity.

3.15.11 Warranty

The contractor shall furnish manufacturer's warranty certificate, certifying that the goods supplied conform exactly to the specification laid down in

the contract and are brand new and that in the event of the material being found defective or not conforming to the specifications at the time of delivery and for a period of 24 months from the date of delivery.

The contractor will be held responsible for all losses and that the defective / unacceptable goods shall be substituted with the acceptable goods at the contractor's expenses and Cost.

4. M.V PANELS

4.1 SCOPE

This Section covers the detailed requirements of low voltage switch panel for 440/415 V, 3 phase 50 Hz 4 wire system. These shall be branded and/or assembled/ fabricated from a factory of repute. All switchgears shall be fully rated at an ambient of 40°C.

4.2 TYPE OF PANEL

The low voltage switch board panel shall comprise of any one of the following types of switchgears or combination thereof as specified.

(a) Switch Disconnector Fuse Units fixed type, MCCBs of suitable ICs ratings.

MCCBs shall invariably be Current Limiting type. Features like Double Break, Positive Isolation functions shall be preferred. The Panel shall be indoor type having incoming sectionalization and outgoing switchgears as specified. The design shall be cubical type. The degree of enclosure protection shall be IP 42 as per IEC 60298.

4.3 M.V PANEL

4.3.1 General Construction

The switchboard shall be floor mounted free standing totally enclosed and extensible type. The switch board shall be dust & vermin proof and shall be suitable for the climate conditions as specified. The design shall include all provisions for safety of operation and maintenance personnel. The general construction shall conform to IEC-61439 for factory assembled switch board.

4.3.2 Cubical Type Panels

4.3.2.1 Cubical type panels shall be fabricated out of sheet steel not less than 2.0 mm thick. Wherever necessary, such sheet steel members shall be stiffened by angle iron frame work. General construction shall employ the principle of compartmentalization and segregation for each circuit. Unless otherwise approved, incomer and bus section panels or sections shall be separate and

independent and shall not be mixed with sections required for feeders. Each section of the rear accessible type panel shall have hinged access doors at the rear. Overall height of the panel shall not exceed 2.4 meters. Operating levers, handle etc. of highest unit shall not be higher than 1.7 meters. Multi-tier mounting of feeder is permissible. The general arrangement for multi-aesthetic look. The general arrangement shall be approved before fabrication. Cable entries for various feeders shall be either from top or bottom. Through cable alleys located in between two circuit sections, either in the rear or in the front of the panel. All cable terminations shall be through gland plates. There shall be separate gland plate for each cable entry so that there will not be dislocation of already wired circuits when new feeders are added. Cable entry plates shall therefore be sectionalized. The construction shall include necessary cable supports for clamping the cable in the cable alley or rear cable chamber.

Cubical panels with more than 1000 Amps bus shall be made of tested structural modular sections.

4.3.2.2 ***Bus Bar and Connections***

The bus bars shall be of Copper of high conductivity electrolytic quality and of adequate section. Current density for copper shall not exceed 160 amps./cm^2. The bus bar system may comprise of a system of main horizontal bus bars and ancillary vertical bus bars run in bus bar alleys on either side of which the circuit could be arranged with front access cable entries. In the case of rear access, horizontal bus system shall run suitably either at the top or bottom. All connections to individual circuits from the bus bar shall preferably be solid connections; however flexible connections shall also be permitted as per recommendations of the Panel Manufacturer. All bus bars and connections shall be suitably sleeved / insulated in approved manner.

4.3.2.3 ***Incomer / Termination***

Incomer termination shall be suitable for receiving bus trunking / underground cables. Cable terminations shall invariably be through terminal blocks (Polyamide or superior) or brought out solid terminals.

4.3.2.4 ***Instruments***

All voltmeters and ammeters shall be flush mounted of size minimum 96 mm conforming to class 1.0 of IEC 60051-1, IEC 61010-1 and IEC 61000-4 for accuracy. All voltmeters shall be protected with MCB.

4.3.2.5 *Indicating Lamps*

On all the incomers of M.V panels, ON/OFF indicating LED lamps shall be provided and shall be suitable for operation on AC supply. Phase indicating LED lamps shall be associated with necessary ON/OFF toggle switch.

4.3.2.6 *Small Wiring*

All small wiring for Controls, Indication etc. shall be with suitable FRLS/ HFFR (halogen free fire retardant) copper conductor cables. Wiring shall be suitably protected within switch board. Runs of wires shall be neatly bunched, suitably supported and clamped. Means shall be provided for easy identifications of the wires. Where wires are drawn through steel conduits, the works shall conform to WAPDA/PEPCO/HESCO Standards and International Standards as the case may be. Identification ferrules shall be used at both ends of the wires. All control wiring meant for external connections are to be brought out of terminal board.

4.4 OPERATIONAL REQUIREMENTS

The indoor type MV panel shall conform to the following:

(i) The panel shall comprise of incomers, outgoing feeders and bus coupler as specified. The incomer shall be either a double break / contact repulsion MCCB. The bus coupler shall be either a circuit breaker or a double break / contact repulsion MCCB or switch disconnector fuse unit as specified. The outgoing feeders shall be circuit breakers/ MCCBs as specified

(ii) Bus bars for phase and neutral shall have appropriate rating

(iii) The entire switch panel shall be cubical type generally in accordance with clause 4.3.2 or factory assembled switch board

(iv) The incomer panel shall be suitable for receiving bus trunking or MV cable of size specified either from top or from bottom

(v) All incoming MCCB shall have suitable adjustable tripping current and the time delay settings

(vi) The entire panel shall have a common earth bar of size as specified with two terminals for earth connections

4.5 RATING AND REQUIREMENTS

4.5.1 MCCB

All MCCBs shall be current limiting type with features of load line reversibility and suitable for Horizontal/ Vertical mounting without any derating. Beyond 300 Amps capacity MCCBs shall have positive isolation and preferably double break / contact repulsion & double insulation features.

The MCCBs shall invariably be used with terminal spreaders.

4.6 TEST AT MANUFACTURERS WORK

All routine tests shall be carried out and test certificates produced to the department.

4.7 INSTALLATION

The installation work shall cover assembly of various sections of the panels lining up, grouting the units etc. In the case of multiple panel switch boards after connecting up the bus bars etc., all joints shall be insulated with necessary insulation tape or approved insulation compound. A common earth bar as per section 7 of these specifications shall be run inside at the back of switch panel connecting all the sections for connection to frame earth system. All protection and other small wirings for indication etc. shall be completed before calibration and commissioning checks are commenced. All relays, meters etc. shall be mounted and connected with appropriate wiring.

4.8 TESTING AND COMMISSIONING

Commissioning checks and tests shall include all wiring checks and checking up of connections. Relay adjustment/setting shall be done before commissioning in addition to routine Megger tests. Checks and tests shall include the following;

(i) Operation checks and lubrication of all moving parts
(ii) Interlock function checks
(iii) Continuity checks of wiring, fuses etc. as required
(iv) Insulation test: When measured with 500 V Megger the insulation resistance shall not be less than 100 mega ohms
(v) Trip tests and protection gear test

5. CABLE WORKS

5.1 SCOPE

This section covers supply, laying and jointing as required and testing and energizing all cable work.

5.2 SPECIFICATION OF CABLE

5.2.1 11 kV grade XLPE insulated PVC sheathed Copper cable shall be 3-core earthed of sizes as specified. The cable shall be in accordance with IEC 60502-2

5.2.3 All control wires shall be 650 V grade copper conductor halogen free fire retardant or FRLS PVC insulated, conforming to IEC 60332 and BS 6004. The minimum size of the control wires shall be 1.5 mm^2

5.3 INSTALLATION

Cable shall be laid in ground, trenches, and cable trays and on walls as required. Installation shall include all supports and clamps as required. The complete work shall be in accordance to WAPDA/PEPCO/HESCO standards. As far as possible cables shall not be fixed on walls directly but laid on cable trays.

5.4 TESTING

Testing of the complete cable installation shall be as per WAPDA/PEPCO/HESCO specifications.

5.5 POWER DISTRIBUTION SYSTEM LOSSES

The power cabling shall be adequately sized as to maintain the distribution losses not to exceed 1% of the total power usage. Record of design calculation for the losses shall be maintained.

The cables be designed as per the voltage drop regulations at peak load, and the losses be calculated on the basis of the assessed load during the day, week and year and should not be limited to the peak load.

6. BUS TRUNKING

6.1 SCOPE

The specification covers the technical requirements of design, manufacture, test at works, supply, testing & commissioning of following;

- 415V LT, Sandwich type bus bar trunking for use as feeder bus bars for connection between electrical panels / load centers, and for use as plug in bus bar risers in indoor applications
- 415V LT, Cast resin type bus bar trunking for use as feeder bus bars for connection between electrical equipment for Outdoor applications

6.2 CODES & STANDARDS

6.2.1 IEC Standards

- IEC 439 –2 Particular requirements of bus-bar trunking systems
- IEC 529 Degree of protection
- IEC 60439 (Part 1&2) Bus-bar trunking systems (bus-ways)
- IEC 60331 applicable for the cast resin bus bar – fire rating

6.2.2 British Standards

- BS 5486 Part 2: Particular requirements of bus-bar trunking systems

6.3 SYSTEM DETAILS

The bus-bar shall be suitable for operation in a 600/1000V system; with frequency of either 50 Hz. System shall be earthed or unearthed

6.3.1 General

The bus bars shall be of sandwich construction, non-ventilated design. It shall be possible to mount the bus bar system in any orientation, without affecting the current rating. The sandwich bus bar configuration must be compatible with the cast resin bus bar, and must allow for interconnection of the two types, wherever required.

Termination chambers flexible joints. The bus-duct shall be manufactured to suit the terminal flange arrangements of the transformer & LT Switch gear.

6.3.2 Bus Bars

The bus bars shall of high conductivity Copper as specified in the tender.

Where an earth conductor is required, it shall be a separate, integral earth conductor, of the same high conductivity material as the phase conductors, and at least 50% cross section of the phase conductor. GI body / GI strips shall not be acceptable as earth conductors.

It should be possible to provide a 200% Neutral where specified.

End terminations and length beyond 4.5 mtrs shall be provided with necessary flexible connectors for bus expansion and contraction. Include all independent section at both ends.

Ends of bus duct connecting to transformers, LT Switchgear shall be provided with flexible flange connectors.

Bolted type splice plate, High Tensile Set (HTS) zinc plated bolts and nuts with washers, shall be used to achieve an efficient joint. Joining method shall be as per international practice and the manufacturer should submit proof, customer may call for testing to verify. Bidder shall submit calculation for selection of bus bars, support insulator spacing, for approval.

6.3.3 Insulation

The bus bars shall be insulated throughout their length by epoxy coating.

- The insulation material used shall be of Class H (180 °C)
- The insulation should be 100% water resistant even for IP 42 trunking
- The insulation must comply UL 94 V-O. It shall be Halogen Free

6.3.4 **Housing**

The housing shall be made of 1.6 mm electro galvanized sheet steel, with an epoxy powder coated paint finish. The housing shall be profiled, to provide higher strength and efficient heat dissipation. The width of the housing shall preferably be the same for all ratings of bus bars, in order to provide interchangeability of tap off boxes.

6.3.5 **Joints**

The joints between sections shall be made so as to provide flexibility during installation and expansion / contraction of bus-bar during operation. The joints shall be of the single bolt type.

The joint construction must have the following features;

- Heat expansion of at least 3 mm per joint
- The joint insulation must be of one piece molded design and not have any cut edges which can absorb moisture
- The joint construction must allow a ±14 mm adjustment at the time of installation, for ease of adjusting to site measurement variations
- The joint bolt must be insulated with a bolt insulator. The bolt insulator must be of moided one piece
- The joint system must be designed in a way that the installer cannot insert the bus duct length too far and damage the bolt insulator.
- The bus-bar ends shall not have holes or slots at the joints – the electrical continuity
- Shall be through pressure plates, achieving a high area of joint cross section and expansion capability
- It shall be possible to install and remove the joints without disturbing the bus-bar run

6.3.6 **Tap OFF Units**

Where specified, tap off locations shall be provided for insertion of plug in tap off units. The tap off locations shall be covered by hinged plates.

Tap off units safety features;

- When the door cover is open, it should not be possible to turn the MCCB on
- This should be by means of mechanical safety locking system and not by the rotary handle of the MCCB
- The door shall be provided with a lock and keys
- When the lever is in 'on' position, even with the key unlocked, the operator should not be able to remove the box or open the tap off location cover

- During insertion, the earth conductor shall make contact first before the phase conductors. This should follow the sequence of first in last out concept
- The tap off unit handle shall be flexible in the sense that the 'on/off' handle can be attached to the left or right side of the box, depending on the site situation
- When the box is open the live conductors shall be safe guarded by a transparent insulator plate which allows for visible inspection but does not allow touching of the Live conductors
- In the event of a MCCB requiring maintenance or changing, the mechanical interlocking must allow easy access by removing only the front plate and not interrupting the adjacent linkages
- For IP55 bus-trunking, the tap off unit arrangement also must achieve IP55 without requiring any additional sealing at site. The complete arrangement with the tap off unit shall be tested for IP rating by an independent test authority
- The tap off boxes will be suitable for accommodating MCCB's or other accessories, as required. The tap off units should allow the flexibility of accommodating different, reputed MCCB makes to be mutually agreed depending on the tender requirements

6.3.7 Accessories

A full range of accessories like bends, end flanges, end feed units and supporting brackets etc. shall be available.

6.3.8 Earthing

The bus duct enclosure shall be earthed by a continuous Copper earth bar of 50x6mm size, running on both sides of the enclosure throughout the entire length of the bus-duct.

6.3.9 Name Plate

Suitable name plate shall be provided in bus riser containing Manufacturers name, Voltage rating, current rating, frequency etc. which shall be clearly visible after installation.

6.3.10 Danger Plate

Danger plate made of Anodized aluminum with white letters on red background fixed by rivets.

6.4 TESTS

Bus-bar shall be completely assembled, adjusted and tested for operation under simulated conditions to ensure proper functioning.

The bus bars shall be tested for short circuit withstand. The test shall be for a minimum duration of 1 second. Tests shall be performed over a range of current ratings, covering the different frame sizes of the manufacturer.

Degree of ingress protection (IP rating) shall also be tested at any reputed independent laboratory. This test shall be for IP68 in the case of cast resin bus bars and for IP42 / IP55 / IP66 for sandwich bus bars 750 °C fire test (for cast resin bus bars) at an independent laboratory.

6.4.1 **Routine Tests**

- Mechanical Operation Test
- Dielectric Test

6.5 DRAWINGS AND MANUAL

General arrangement showing the plan, elevation, different views, detailed typical cross section of bus-duct, details of expansion joint, termination arrangement at both ends, bus bar arrangement at both ends, erection details with necessary supports.

- Overall Dimensions of different
- Terminal locations
- Total weight / meter.
- Sectional view of Tap off box
- Fixing details
- Manufacturing schedule and test schedule
- Calculation for bus-bar sizing
- O & M Manual

6.6 IDENTIFICATION LEBEL

Each piece of the Bus Riser shall be provided with suitable identification label for easy identification while installation.

6.7 DEVIATION

Deviation from this specification, if any, shall be clearly bought out in the offer. Unless owner explicitly accepts such deviations, it shall be constructed that the offer fully complies with the specification.

6.8 PACKING & DISPATCH

All the equipment covered under this specification including all accessories shall be properly packed and delivered at the site without any damage.

Note: The tender drawing and the conductor size indicated in the drawings and BOQ shall be used only for reference and guidance.

Successful tenderer shall provide all the above details based on the requirements specified in the tender document.

6.9 SPECIFIC REQUIREMENTS OF LT VERTICAL RISER

S.No.	Description	Data
1.	Service	Partially Outdoor / Partially Indoor
2.	System nominal voltage	415V
3.	Rated continuous current	2000A
4.	System frequency	50 Hz
5.	Number of phases	3P + N
6.	Insulation Levels	
	a. Insulation level 1 min dry power frequency withstand voltage	2.5kV r.m.s
7.	Short circuit rating for duration of 1 Sec.	50kA / 1 Sec.
8.	Dynamic with-stand current	100kA Peak
9.	Bus-bar	
	a. Bus-bar Material	Copper
	b. Minimum phase to phase clearance (clear)	As per standards
	c. Phase to body clearance (clear)	As per standards
	d. Phase to neutral (clear)	As per standards
10.	Enclosure	
	a. Material	CRCA Sheet steel
	b. Thickness	2mm
11.	Cooling	Self-cooled
12.	Degree of Protection	IP 42
13.	Earthing	
	a. System Earthing	Earthed
	b. Neutral Ground	Solidly earthed
	c. Earth Bus	50 x 6 Copper
14.	Design Ambient Temperature	50° C
15.	Applicable Standards	IEC 60439-2 / BS 5486-2 /NEMABU1
16.	Acceptance Tests	As per IEC

6.10 SPECIFIC REQUIREMENTS OF LT 2500A BUS-DUCT

S. No.	Description	Data
1.	Service	Partially Outdoor / Partially Indoor
2.	System nominal voltage	415 V
3.	Rated continuous current	2500 A
4.	System frequency	50 Hz
5.	Number of phases	3P + N
6.	Insulation Levels	
	a. Insulation level 1 min. dry power frequency withstand voltage	2.5 kV r.m.s
7.	Short circuit rating for duration of 1Sec	50 kA / 1 Sec
8.	Dynamic with-stand current	100 kA Peak
9.	Bus-bar	
	a. Bus-bar Material	Copper
	b. Minimum phase to phase clearance (clear)	As per standards
	c. Phase to body clearance (clear)	As per standards
	d. Phase to neutral (clear)	As per standards
10.	Enclosure	
	a. Material	CRCA Sheet steel
	b. Thickness	2 mm
11.	Cooling	Self-cooled
12.	Degree of Protection	IP 42
13.	Earthing	
	a. System Earthing	Earthed
	b. Neutral Ground	Solidly earthed
	c. Earth Bus	50 x 6 Copper
14.	Design Ambient Temperature	50° C
15.	Applicable Standards	IEC 60439-2 / BS 5486-2 /NEMABU1
16.	Acceptance Tests	As per IEC

7. EARTHING SYSTEM

7.1 SCOPE

This section covers the general requirements of the earthing system for Sub-station installation. G.I. plate earthing with G.I. strip for sub-stations up to 500 KVA capacity and copper plate earthing for sub-stations of higher capacity shall preferably be used.

7.2 SYSTEMS

Earthing system shall comprise earth electrodes in accordance with IEC 62561-2. For every additional transformer 2 more separate and distinct earth electrodes shall be provided for neutral earthing. The body earthing for transformers, HV & MV panels shall be done to a common earth bus connected to two separate and distinct earth electrodes.

Note: For a single transformer Sub-station, the total number of earth electrodes shall be 4 (2 for neutral and 2 for connection to a common earth bus for body earthing).

7.3 ELECTRODES

7.3.1 Conductors

Conductors shall be of high conductivity copper in the form of circular conductors stranded to IEC 228 (BS 6360). Conductor sheaths shall be of yellow-green coloured PVC to meet the requirements of BS 6746 grade TM1 or IEC 502 Grade ST1 with a minimum thickness of 1.5 mm. Earth risers which are not part of the earth electrode mesh system shall be PVC sheathed yellow/green circular stranded cable.

Bare conductors only shall be used for earth electrodes meshes buried below the ground.

Conductors buried in the ground shall normally be laid at a depth of 1m below the ground in an excavated trench. The backfill in the vicinity of the conductor shall be free of stones and the whole backfill shall be well consolidated. Conductors not forming part of a voltage control mesh shall be laid at the depth required by the approved design and, in the case of a yellow-green coloured PVC sheathed conductor, at the same depth as any auxiliary power or control cables following the same route.

All conductors not buried in the ground shall be straightened immediately prior to installation and supported clearly of the adjacent surface.

7.3.2 Earthing Rods

The earth rods shall be of hard-drawn high conductivity copper with a diameter of not less than 19 mm with hardened steel driving caps and tips.

The rods shall be as long as possible but couplings may be used to obtain the overall depth of driving required by the design. The rods shall be installed by driving into the ground with a power hammer of suitable design to ensure the minimum of distortion to the rod. Where it is not possible to drive rods to the full depth required due to the presence of strata of rock, then holes shall be drilled or blasted in the rock. The holes shall be filled with bentonite or other approved material prior to inserting the rod.

If difficult driving conditions arising from hard or rocky ground are encountered or are anticipated or there is a need for deep rods, then high tensile steel rods shall be used. High tensile steel rods shall have a molecularly bonded high conductivity copper coating with a minimum radial thickness of not less than 0.25 mm.

The overall diameter shall be not less than 19 mm. Rolled external screw threads shall be used on the rods for coupling and after rolling the thickness of the copper coating on the threaded portion shall be not less than 0.05 mm. Rods, and driving caps and tips shall treat at couplings to ensure that the couplings and screw threads are not subject to driving forces. All screw threads shall be fully shrouded at the couplings. Alternatively, conical couplings may be used to the approval of Engineer In-charge.

High conductivity copper for earth rods shall have a minimum copper content (including silver) of 99.90%. The steel for copper-clad steel rods shall be low carbon steel with a tensile strength of not less than 570 N/sq.mm. Couplings for copper rods shall be 5% phosphor bronze (copper-tin-phosphorous) and for copper bonded steel rods of 3% silicon or 7% aluminium bronze.

7.3.3 Fittings

Clips for supporting strip conductors not buried in the ground shall be of the direct contact type and clips for circular conductors shall be of the cable saddle type. The clips shall support the conductors clear of the structure.

Conductors shall be connected to earth rods by a bolted clamp to facilitate removal of the conductor for testing the rod. The number and location of links shall be agreed during design.

Disconnecting links shall comprise a high conductivity copper link supported on two insulators mounted on a galvanized steel base for bolting to the supporting structure. The two conductors shall be in direct contact with the link and shall not be disturbed by the removal of the link. Links

for mounting at ground level shall be mounted on bolts embedded in a concrete base.

Disconnecting links mounted at ground level and the connections at the earth rods shall be enclosed in concrete inspection pits, with concrete lids, installed flush with the ground level. All conductor fittings shall be manufactured from high strength copper alloys with phosphor bronze nuts, bolts, washers and screws. Binary brass copper alloys will not be acceptable. All fittings shall be designed for the specific application and shall not be permanently deformed when correctly installed.

Fittings not in direct contact with bare or sheathed conductors may be of hot dipped galvanized steel.

Bi-metallic connectors shall be used between conductors of dissimilar materials and insulating material shall be interposed between metallic fittings and structures of dissimilar materials to prevent corrosion.

7.3.4 **Joints**

Permanent joints shall be made by brazing, exothermic welding or by crimping. Joints for conductors forming part of mesh system shall be exothermic welding by suitable moulds.

Detachable joints shall be bolted and stranded conductors at bolted joints shall be terminated in exothermically welded lugs or a crimped cable socket. The diameter of any holes drilled in strip conductors shall not be greater than half the width of the strip.

Connections to electrical equipment shall be detachable and made at the earthing studs or bolts provided on the equipment by the manufacturer. When an earthing point is not provided the point and method of connection shall be agreed with WAPDA/PEPCO/HESCO/Engineer In charge.

Connections to metallic structures for earthing conductors and bonding conductors between electrically separate parts of a structure shall be either by direct exothermic welding or by bolting using a stud welded to the structure. Drilling of a structural member for a directly bolted connection shall only be carried out to the approval of Engineer In Charge/WAPDA/PEPCO/HESCO.

Bolted joints in metallic structures including pipe work, which do not provide direct metallic contact shall be bridged by a bonding conductor or both sides of the joint shall be separately bonded to earth unless the joint is intended to be an insulated joint for cathodic protection or other purposes.

When the reinforcing in concrete is used as a part of the earthing system the fittings used to provide a connection point at the surface of the

concrete shall be exothermically welded to a reinforcing bar. This fitting shall be provided with a bolted connection for an earthing conductor. The main bars in the reinforcing shall be welded together at intervals to ensure electrical continuity throughout the reinforcing.

7.3.5 Measurement of Earth Resistance

The resistance of the complete earth system shall be measured before installation of outgoing cables by the contractor and with OHL termination towers disconnected from the earth mat with an approved form of earth resistance tester. The measured value shall be submitted for approval and shall not exceed 1 ohm when measured between the earth system and the surrounding earth. On completion of the earth mat system, the step and touch potentials shall be measured in accordance with IEEE/BS/DIN/IEC/WAPDA/PEPCO/HESCO etc.

7.4 LOCATION OF EARTH ELECTRODES

Normally an earth electrode shall not be situated less than 1.5 m from any building. Care shall be taken that the excavation of earth electrode may not affect the column footings or foundation of the building. In such cases electrodes may be farther away from the building.

The location of the electrode earth will be a place where the soil has reasonable chance of remaining moist. As far as possible, entrances, pavements and road ways, are to be definitely avoided for locating the earth electrode.

7.5 WATERING ARRANGEMENT

Method of watering arrangement shall comply with WAPDA/PEPCO/HESCO specifications.

7.6 SIZE OF EARTH LEAD

The recommended sizes of copper earth bus lead in case of Sub-stations shall be in accordance with WAPDA/PEPCO/HESCO standards. The minimum size of earth lead shall be 25 mm x 5 mm copper or equivalent GI strip.

7.7 INSTALLATION

All joints shall be riveted and sweated. Joints in the earth bar shall be bolted and the joints faces tinned. Where the diameter of the bolt for connecting earth bar to apparatus exceeds one quarter of the width of the earth bar, the connection to the bolt shall be made with a wider piece of flange of copper jointed to earth bar. These shall be tinned at the point of connection to equipment and special care taken to ensure a permanent low resistance contact to iron or steel. All steel bolts, nuts, washers etc. shall be cadmium plated, main earth bars shall be spaced sufficiently on the surface to which they are fixed such as walls or the side trenches to allow for ease

of connections. Copper earthing shall not be fixed by ferrous fittings. The earthing shall suitably be protected from mechanical injury by galvanized pipe wherever it passes through wall and floor. The portion within ground shall be buried at least 60 cm deep. The earthing lead shall be securely bolted and soldered to plate or pipe as the case may be. In the case of plate earthing the lead shall be connected by means of a cable socket with two bolts and nuts. All washers shall be of the same materials as the plate or pipe. All iron bolts, nuts and washers shall be galvanized.

7.8 TESTING

After installation, the tests as specified by WAPDA/PEPCO/HESCO standards shall be carried out and results recorded.

8. SAFETY REQUIREMENTS

8.1 SCOPE

This section covers the requirements of items to be provided in the sub-station for compliance with statutory regulations, safety and operational needs.

8.2 REQUIREMENTS

Safety provisions shall be generally in conformity with WAPDA/PEPCO/HESCO and IEC standards. In particular following items shall be provided subject to availability of these items in BOQ of the Bid or approved by the EI;

(a) Insulation Mats

Insulation mats conforming to IEC-61111 Class 3, shall be provided in front of main switch boards as well as other control equipment as specified.

(b) First Aid Charts and First Aid Box

Charts (one in English, one in Urdu, one in Regional language), displaying methods of giving artificial respiration to a recipient of electrical shock shall be prominently provided at appropriate place. Standard first aid boxes containing materials as prescribed by St. John Ambulance brigade or Pakistan Red Crescent Society should be provided in each sub-station.

(c) Danger Plate

Danger Plates shall be provided on HV and MV equipment. MV danger notice plate shall be 200 mm x 150 mm made of mild steel at least 2 mm thick vitreous enameled white on both sides and with the descriptions in signal red colour on front side as required.

Notice plates of other suitable materials such as stainless steel, brass or such other permanent nature material shall also be accepted with the description engraved in signal red colour.

(d) Fire Extinguishers

Portable CO_2 conforming to BS EN 3-10:2009 shall be installed in the sub-station at suitable places. Other extinguishers recommended for electric fires may also be used.

(e) Fire Buckets

Fire buckets conforming to IS 2546: 1974 shall be installed with the suitable stand for storage of water and sand.

(f) Tool Box

A Standard tool box containing necessary tools required for operation and maintenance shall be provided in the sub-station.

(g) Caution Board

Necessary number of caution boards such as "Man on Line" 'Don't Switch on' etc. shall be available in the sub-station.

(h) Key Board

A keyboard of required size shall be provided at a proper place containing castle keys, and all other keys of sub-station and allied areas.

9. TECHNICAL SPECIFICATION FOR TUBULAR STEEL POLES

9.1 SCOPE

This specification covers the general requirements towards design, manufacture, testing at manufacturers works, supply and delivery for tubular steel poles of circular cross section (swaged type) for street lighting.

9.2 Topography and Climatic Condition

The materials offered, shall be suitable for operation in tropical climate and will be subjected to the sun and inclement weather and shall be able to withstand wide range of temperature variation. For the purpose of design, average atmospheric temperature may be considered to be 50°C with humidity nearing saturation.

9.2 Materials

9.2.1 The materials used in construction of tubular steel poles shall be of the tested quality of steels of minimum tensile strength 540 MPa (55 Kgf/mm^2).

9.2.2 The materials, when analyzed shall not show sulphur and phosphorous contents of more than 0.060 percent each.

9.3 Types, Size and Construction

9.3.1 Tubular Steel Poles shall be swaged type.

9.3.2 Swaged poles shall be made of seamless or welded tubes of suitable lengths swaged and jointed together. No circumferential joints shall be permitted in the individual tube lengths of the poles. If welded tubes are used they shall have one longitudinal weld seam only and the longitudinal welds shall be staggered at each swaged joint.

9.3.3 Swaging may be done by any mechanical process. The upper edge of each joint shall be chamfered if at an angle of about 45°. The upper edge need not be chamfered if a circumferential weld is to be deposited.

9.3.4 The length of joints on swaged poles shall be as follows;

Outside Diameter of Smaller Tube in Joint	Length of Joint
mm	mm
76.1	200
88.9	230
114.3	300
139.7	350
165.1	400
193.7	450

9.3.5 Poles shall be well-finished, clean and free from harmful surface defects. Ends of the poles shall be cut square. Poles shall be straight, smooth and cylindrical. The weld joints, if any, shall be of good quality, free from scale, surface defects, cracks, etc.

9.3.6 Tolerances

9.3.6.1 ***Outside diameter***

The poles shall be as nearly circular as possible, and their outside diameters shall not vary from the values specified in the schedule, except at the joint or step, by more than ±1-0 percent.

9.3.6.2 ***Thickness***

9.3.6.1.1 In the case of welded tubes, its thickness shall not fall below the thickness specified by more than 10 percent.

9.3.6.1.2 In the case of seamless tubes, the following tolerances on thickness shall apply:

a) Where the ratio of the thickness to the outside diameter is more than 3 percent, -12·5 percent of the specified thickness; and

b) Where the ratio of the thickness to the outside diameter is equal to or less than 3 percent, -15 percent of the specified thickness.

9.3.6.3 ***Length***

The tolerance on the length shall be as follows:
On the length of any section ±40 mm
On the overall length of pole ±25 mm

9.3.6.4 ***Weight***

The mean weight for bulk supplies shall be not more than 5 percent below the calculated value. The weight of any single pole shall not fall below the calculated weight by more than 7.5 percent.

9.3.6.5 ***Straightness***

The finished pole shall not be out of straightness by more than 1/600 of its length.

9.3.7 The poles shall be coated with black bituminous paint conforming to WAPDA/PEPCO/HESCO standards throughout, internally and externally, up to the level which goes inside the earth. The remaining portion of the exterior shall be painted with one coat of red oxide primer.

9.4 Earthing Arrangements

For earthing arrangement a through hole of 14mm diameter shall be provided in each pole at a height of 300mm above the planting depth.

9.5 Tests and Test Certificates

9.5.1 The following tests certificate of manufacturing company shall be furnished by the contractor conducted on finished poles;

a) Tensile test and chemical analysis for sulphur and phosphorous
b) Deflection test
c) Permanent set test, and
d) Drop test

9.6 Workmanship

9.6.1 When the tubes are made by manual metal arc welding, the welders employed shall be qualified.

9.6.2 The welded joints shall be of good quality, free from scale, surface defects, cracks, etc.

9.7 Marking

9.7.1 The poles shall be marked with designation, manufacturer's identification, year of manufacture and name of the purchaser.

9.7.2 The poles may also be marked with the certification mark if applicable.

9.8 Guaranteed Technical Particulars

The contractor shall furnish all necessary guaranteed technical particulars conforming to the technical specifications given by the tenderer.

9.9 Deviation

Any deviation in technical specification shall be clearly indicated with sufficient reasons thereof. Client shall however reserve the right to accept and/or reject the same without assigning any reasons what-so-ever.

10. LIGHTING FIXTURES

10.1 General

10.1.1 The Contractor shall supply and install lighting fixtures including but not limited to lamps, ballasts, accessories fixing hardware necessary for installations, as shown on the Drawings, as required, and as herein specified.

10.1.2 All fixtures shall be delivered to the building complete with suspension accessories, canopies, hanging devices, sockets, holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc. all wired and assembled as indicated.

10.1.3 Full size shop detail drawings of special fixture or lighting equipment, where called for in the fixtures schedule, shall be submitted to the Engineer in-charge for approval.

10.1.4 Fixtures, housing, frame or canopy, shall provide a suitable cover for fixture outlet box or fixture opening.

10.1.5 Fixtures shall comply with all applicable requirements as herein outlined unless otherwise specified or shown on the Drawings.

10.1.6 Manufacturer's name and catalogue number of lighting fixtures are given for general reference only. It shall be understood that the actual fixtures supplied shall meet all the requirements of the specification, and, if necessary, the standard fixture indicated for reference, shall be modified accordingly.

10.1.7 Fixtures shall bear manufacturer's name and the factory inspection label.

10.1.7 Fixtures shall be completely wired and constructed to comply with the IEE wiring regulations requirements for lighting fixtures, unless otherwise specified.

10.1.8 Revamping the fixture shall be possible without having to remove the fixture from its place.

10.2 Street Pole Light Fixture

10.2.1 Fixture shall be supplied and installed, listed in the schedules of Lighting Fixtures on the drawings and as per IEC-598.

10.2.2 Fixture shall be of one piece deep drawn high quality optical system for clear tubular lamps.

10.2.3 Fixtures shall have easy access and maintenance of gear and lamp.

10.2.4 Material shall be non-corrosive, high pressure die-cast aluminum housing and spigot high purity aluminum reflector, clear curved glass toughened bowl, silicone rubber gasket, all external fixings in stainless steel.

10.3 Wiring within the Fixtures

10.3.1 Fixtures shall be wired with not smaller than 1.5 sq. mm asbestos-covered wire. No splice or tap shall be located within an arm, stem or chain. Wire shall be continuous from splice in outlet box of the building wiring system to lamp socket or to ballast terminals.

10.4 INSTALLATION

Fixtures shall be installed at mounting heights as detailed on the Drawings, Schedule or as instructed on site by the Engineer-In-charge.

Pendent fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation.

Fixtures mounted outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Extension pieces shall be installed where required to facilitate proper installation.

10.5 LAMPS

10.5.1 General

10.5.1.1 Lamp shall be supplied and installed in all lighting fixtures listed in the schedules of Lighting Fixtures on the drawings.

10.5.1.2 Lamps used for temporary lighting service shall not be used in the final fixture units.

10.4.1.3 Lamps shall be of wattage and type as shown in the Schedule of Lighting Fixtures.

10.5.1.4 Lamps for permanent installation shall not be placed in the fixtures, until so directed by the Engineer In-charge and this shall be accomplished directly before the building areas are ready for occupancy by the Client.

10.5.2 Lamps – HPI / MH

10.5.2.1 Lamp position shall be adjustable to obtain several light distributions.

10.5.2.2 Lamp compartment shall be dustproof and jet proof (IP-66), no internal cleaning requirement.

10.5.2.3 Lamps shall be manufactured by reputed indigenous manufacturers.

10.5.3 Ballast

10.5.3.1 Ballasts shall be high power factor type.

10.5.3.2 Ballasts shall have manufacturer's lowest sound level and case temperature rise rating.

10.5.3.3 Ballasts shall be special cool operated type.

10.5.3.4 Ballasts shall be of the same manufacture as the lamps.

10.6 FIXTURE SAMPLES

Detailed catalogue for all fixtures or if so required by the Engineer In-charge sample fixtures shall be submitted for prior approval of the Engineer In-charge before orders for the fixtures are placed.

10.7 TESTING

After all lighting fixtures are installed and are connected with their respective switches. Test all fixtures to ensure operation on their correct switch in the presence of the engineer in charge / engineer's representative.

11. Conduit and Wiring Accessories

11.1 The conduit wherever concealed in masonry shall be of rigid PVC B-Class 6kg/cm^2 pressure manufactured by Pakistan PVC D-Class 12 kg/cm^2 pressure. Where no permitted because of dampness of fire, steel conduit of 16 SWG shall be installed. The conduit system shall be concealed in masonry wall, floor with required minimum concrete over it where not possible due to structural reasons; the conduit shall be exposed clipped to wall or roof.

11.2 Separate conduit shall be laid for different system, the mains, power such circuit and control wiring b/w control and the outlet.

11.3 The drawings indicate the suggestive runs for the various routes of the wiring as well as position of outlet. Minor change to suit actual construction shall be acceptable for which special and specific details be indicated in the shop drawing for the approval of the EI/Engineer's Representative. The contractor shall keep true record of all conduit layouts and submit as installed drawings before finally handing over the installation.

11.5 For the jointing of PVC conduit, PVC adhesive solution of approved make shall be applied to all joint and junction boxes to ensure proper sealing. Exposed conduit wherever utilized shall be securely fastened in place by means of approved conduit supports and fasteners. Where Conduit/pipe is to be fastened to masonry walls, floor or portion use of wooden block will not be permitted. Metal saddles of approved type not more than 4' apart shall be used for fixing exposed conduit.

11.6 The conduit shall be fastened to the box coupling and lock nut and insulating bushing approved make and type.

12. Low Tension Cable

12.1 All the low tension cables shall be of size specified on the drawing or stated in the schedule of Quantities, single core, 3 core, or 3-1/2 core as required, polyvinyl chlorides (PVC) insulated and PVC sheathed. The cables shall be used either in floor in floor trenches is in conduit and thereof should be suitable fir above conditions.

12.2 The copper used in manufacture of cables should conform to B.S.S. 10 or equivalent standard, having an electrical conductivity of not BSS 2004 & 2746 and should have heat stability and volume resistivity in accordance with the standard laid down by cable manufactures association (U.K.)

12.3 All the cables shall comply the test requirements of B.S.S. 200:1961.

12.4 The low tension cables shall be four cores with reduced neutral or 3 core as described having copper conductors of standard, a healed, electrolytic, high conductivity copper wires PVC insulated and PVC compound sheathed armored and non-armored and non-armored. The voltage grade shall be 1000/600 volts. The cables shall conform to B.S.6346:1969 and I.E.C. standard 502-1:1978.

12.5 The copper conductor will meet the requirements M.S. 6360:1969 and IEC grade specifications of ASTM.

12.6 Core identification shall be by colors. Red, Yellow, and blue will indicate the three phase and black, the neutral.

12.7 The cables shall comprise of shaped stranded copper conductor, PVC insulated, tapped bedding galvanized steel wire armor and PVC over sheath.

12.8 The cables shall be capable of operating at a maximum continues temperature of 70 ^{0}C and short circuit temperature of 150 ^{0}C. The cables shall be suitable for operation on 415 Volts 4 wire 50 Hz AC system with the neutral point solidly earthed at transformer.

12.9 Technical particular of L.T. PVC/PVC cable shall be furnished for each size of the cable offered and mentioned in B.O.Q.

13. L.T. CABLE GLANDS, CLIPS & LUGS

13.1 Cable glands shall comprise of gland body, compression ring. Armor ring (Where required) gland and conduit thread.

13.2 Cable glands shall be suitable for size of cable used and shall conform to BS 6121:1973.

13.3 All termination of PVC insulated cable shall be in compression connectors and termination. The lugs shall be manufactured from high conductivity copper, electro plated to resist corrosion and give good electrical continuity. Lugs shall be fitted by Compression tools made for the purpose.

13.4 Correct type of cable clamps and clips shall be used where needed. These shall be selected according to cable manufactures recommendations.

14. Distribution Panels

14.1 The Distribution panels shall be totally enclosed metal clad, safety dead front type with hinged door and built – in concealed locks. The panels shall be suitable for working Voltage for which the equipment incorporated there in is designed for and tested in accordance with B.S. 116/1952.

14.2 The panels shall be constructed from 14 SWG sheet steel and shall accommodate circuit breakers, fuse switches distribution board, metering equipment, bus bars supports, cable glands and other relevant equipment.

14.3 The panels shall be finished inside and outside the hammer light gray air drying enamel and two finishing coats shall be applied after basic coat of anticorrosive primer. & Oven baked.

14.4 The mountings on the panel shall be earthed by means of earthling the entire pane through the two earthling terminals specifically provided for this purpose.

14.5 The panel shall be equipped with a terminal block of suitable rating and all out going connections shall be brought to that terminal block. The terminal block shall have a minimum 20% spare capacity for future use.

14.6 All panel enclosures shall have protection class I.P.54 as per DIN 4050 and IEC regulation.

14.7 Panel Boards

The protective devices in the boards shall be miniature circuit breakers (MCBs) of the Quantities and ratings specified in the Bill of Quantities/Drawings. The Circuits Shall be connected to the respective/MCBs. The MCBs shall be suitable for minimum 5 KA rupturing Capacity and designed for 2000 switching operation.

15. Earthing

15.1 All exposed non-current carrying metallic part of the electrical equipment; flexible conduit switch gear shall be efficiently earthed.

15.2 The specifications are given here as under:

15.2.1 The earthing of the individual distribution points etc., shall be done as specified exclusively and Independently of the sub-station earthing.

15.2.2 For earthing of L.T. equipment earths shall be provided with copper plate earthing electrode. The earthing connections to the Neutral point shall bear distinct indicates, 'NOT TO DISCOUNT'. Excavation of the pit in the soil does the site refilling the pit with earth, lime and Charcoal, watering consolidation and ramming the layers to full compactness.

15.2.3 The earth shall consist of 2x2'1/8" copper plate as specified hereafter and buried in the ground at a depth of 15 feet or more according to the moisture in the strata Two earthing leads of the required size (circular) pipe of the size specified straight from the earth plate upto the point in the installation to the earth. A tee shall be provided at the vertical and extended in a manhole of 12"x12" size of inject water casually.

15.2.4 The earth lead shall be of soft annealed electrolytic copper strip. Size 1 ½" x1/4' two such leads shall be brought out from each earth plate conforming to B.S.S. No.899 and shall be run in a 4" diameter hums pipe, as far as in the ground till it trench of the sub-station, where it shall be properly fixed on saddle and support.

15.2.5 The upper end of hums pipe, shall be terminated in a manhole so as to inject the water for improving the earth resistance, as and when necessary.

15.2.6 The earthing leads shall be terminated on the earthing block.

15.2.7 The connection between earth lead, earth plate or earth LR lead/earth bar shall be with 3/16" diameter bolts conforming to B.S.S. NO. CP. 326.101 of 1948. The contact surface shall be silver coated before fixing and silver soldered after fixing. The connection with earth plate shall be at two distinct suitably spaced points.

15.2.8 There shall be no joint in the earthing leads between the earthing plate and earth block.

15.2.9 The earthing bar for the sub-station earth shall be cast and machined in electrolytic copper, conforming to B.S.S.I., 400. The size of earthing block shall be least 4"x12"x5/8". The earthing block shall be suitable for interconnections of two sets of earth leas 1-1/2x1/8" suitable number of brass bolt terminals shall be provided for terminating the earth leads from various load points as well as sheathing of all the outgoing cables.

15.2.10 The earth leads of sot annealed, electrolytic copper strip, size 1'x1/8" conforming to B.S.S. 899 shall be used to earth all the control panels installed in the sub-station and a separate lead of 1 ½" x ¼" for earthing neutral point. All the other equipment shall be earthed by circular copper conductors or as specified otherwise.

15.2.11 All the joints made in the strips shall be riveted in accordance with clause No.802 of G.P. 326 101. The surface, before riveting shall be silver plated, and soldered after riveting.

15.2.12 The ends of the circular earth conductors shall be tinned after twisting, so as to ensure the minimum contact resistance throughout its useful life.

15.2.13 The earth plates, for different earth shall be buried at least 30 feet apart so that their resistance shall not overlap.

15.2.14 The shortest route to the earth the electrode shall be adopted but sharp bends and joints shall in all cases be avoided. The earthing leads shall be connected to the earthing electrodes by means of sweating sockets, bars nuts, bolts and double washers so fixed to make a permanent and positive connection with the earthing electrode.

15.2.15 The maximum continuity resistance from any point in the installation including earthing leads to the earth plate shall not be exceed 1 ohm. The contractor therefore, must ensure that the earth leads are efficiently bonded to all metal works other than the current carrying parts so that the above resistance limit is no exceeded. Contractor shall arrange testing in the presence of the Engineer as required under IEE **'WIRING REGULATIONS'** and submit certified copies to the Engineer.

SPECIAL NOTES

SPECIAL NOTES

1. All the quantities related with cables given in Bill of Quantities are approximate. It is the responsibility of the Contractor to determine the actual quantities. Payment shall be made against the quantities actually executed at site according to measurement.

2. The contractor will place the order for all the material to be used at site and in his scope of works well in time so that delivery of these materials should not affect the schedule of completion of works. No excuse for the late delivery of the materials by other manufacturers shall be accepted in this regard.

3. Connections on both sides of the cables shall be performed.

4. The contractor shall include in his rates the cost of the cable accessories such as copper lugs, glands, cable end box etc, wherever required. Increase in rate(s), will not be possible after approval of the rate(s) and during execution of works.

5. For extra works carried out according to instructions of the Client and/or Consultants, or their representatives, the rates claimed for these works will be approved by the Client/Consultants after mutual discussion with contractor.

6. Quoted Tender documents, Tender Drawings and Addendum (if any) etc, shall be submitted on the date Tender opening.

7. Contractors/Bidders are advised to visit and understand the quantum of works unvalued in existing areas before filling the BOQ

8. Contractors/Bidders may contact Consultants for clarification of each and every query before filling the BOQ. No alteration in the rates will be entertained after submission / approval of the Tender documents.

9. Contactor is required to submit list of materials required from owner, such as Power Plug etc and get the same from the owner. If the total quantity is not available with client then acquire partial quantities from client and partial from market as per site condition

LIST OF APPROVED ELECTRICAL MANUFACTURERS

LIST OF RECOMMENDED MANUFACTURERS
ELECTRICAL WORKS
FOR
500KVA SUB-STATION & STREET LIGHTING
FOR THE BUILDINGS OF
STUDENT SERVICE CENTER & SPORTS COMPLEX (GYMNASIUM HALL)
MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY (MUET), JAMSHORO

S. No.	Name of Component/System	Manufacturer	Local Agent/Contact Person	Contact Number
1.	500kVA KIOSK Sub-Station	Pak Electron Ltd. (PEL)	Feroz Hassan Jamro (Asstt. Manager-Sales)	0320-2073129
2.	H.T/L.T Panels for KIOSK Sub-Station			
3.	Load Break Switch	Areva		
4.	Auxiliary Relay		Syed Zeeshan Ejaz (Sales & Marketing Engineer)	0300-2140257
5.	Capacitor Trip Unit	E-Lab		
6.	Buzzer	Kacon		
7.	Insulators	G.J. Malaysia		
8.	Anti-Condensation Heater	E-Lab		
9.	Surge Arrestors	CPS		
10.	Distribution Board	Power Protection Services (PPS) Karachi	Muhammad Faisal	0301-2297443
		Best Electric Panels, Hyderabad	Muhammad Owais Shaikh	022-3863232 022-3813535
11.	MCCB	Terasaki, Japan	Jubilee Corporation Salik Mehmood (Project Sales Engineer)	021-32602211
		Hager, France		
		Schneider Electric	Mr. Farrukh Khan (Asstt. Manager-Sales)	111-777-888
12.	MCB	Terasaki, Japan	Jubilee Corporation Salik Mehmood (Project Sales Engineer)	021-32602211
		Hager, France		
13.	Current Transformer	Terasaki Japan Revalco, Italy	Jubilee Corporation Salik Mehmood (Project Sales Engineer)	021-32602211
14.	Voltmeter/Ammeter (Digital)	Revalco (Italy) Autonics (SWE Taiwan)	Jubilee Corporation Salik Mehmood (Project Sales Engineer)	021-32602211
15.	Voltmeter/Ammeter Selector Switch	K&N (Kraus & Naimer), New Zealand	Jubilee Corporation/Salik Mehmood (Project Sales Engineer)	021-32602211
16.	Indication / Pilot Lamp	Lovato Italy	Jubilee Corporation Salik Mehmood (Project Sales Engineer)	021-32602211
		Maruyasu, Japan		
17.	Cables, Wires, & ECC. (Bare Copper Conductors)	Pakistan Cables Ltd.	Wasim Ahmed (Senior Sales Executive)	021-32561170-75
		Newage Cables Ltd.	Syed Farhan	021-35837577
18.	Light Fixtures	Phillips Electrical Industries of Pakistan Ltd.	Taimoor Waseem (Senior Lighting Application Specialist	021-35644263
			Haris Masood (Accounts Manager)	021-35644262
		Pierlite	Talib Hussain (Sales Manager)	021-353609972
15.	PVC Conduit	Dadex	Amir Hussain (Area Manager - Retail & Distribution - South)	021-35397002-9 (Ext. 106)
		Pak Arab		

BILL OF QUANTITIES

i. 500 kVA KIOSK SUB-STATION NO.15 FOR THE BUILDINGS OF STUDENT SERVICE CENTER & SPORTS COMPLEX (GYMNASIUM HALL)
ii. PROVISION OF STREET LIGHTING FOR THE BUILDINGS OF STUDENT SERVICE CENTER & SPORTS COMPLEX (GYMNASIUM HALL)
iii. SHIFTING IF SUB-STATION NO.06 TO NEW GIRLS' HOSTEL

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY (MUET), JAMSHORO

MAIN SUMMARY

S. No.	Description	Amount (Rs.)	
1		Rs.	
2	**Section-2:** Shifting of Sub-Station No. 06 for New Girls' Hostel (Non-Scheduled Items) ***This amount carried from page no:151***	Rs.	
3	**Section-3:** Street Pole Lighting (Gymnasium & Student Service Center) - (Scheduled Items) ***This amount carried from page no:152***	Rs.	
4	**Section-4:** Street Pole Lighting (Gymnasium & Student Service Center) - (Non-Scheduled Items) ***This amount carried from page no:153***	Rs.	
5	**Section-5**: Distribution Board & Cables (Scheduled items) ***This amount carried from page no:154***	Rs.	
6	**Section-6:**Distribution Board & Cables (Non-Scheduled items) ***This amount carried from page no:155***	Rs.	

TOTAL AMOUNT	***Rs.***	

Amount in words _____

SIGNATURE OF BIDDER

SEAL OF BIDDER

Section No. 01: 11KV UNDERGROUND CABLE & 500KVA KIOSK SUB-STATION WITH LBS
[Non-Scheduled Items]

S.No.	ITEM DESCRIPTION	QTY	UNIT	RATE (Rs)	TOTAL AMOUNT (Rs)
1.	Providing, laying, connecting, testing and commissioning of 11 KV, 3 core 25 sq.mm XLPE insulated, copper conductor unarmored cable to be laid between sub-station S/S-Diversion of existing 70 sq.mm, H.T, XLPE, be laid in 3 feet depth trench, complete making of trench cable warning tiles as per specifications.	270	Mtr.		
2.	Providing and installing 100 x 100 x 5 mm cast iron cable marker at each 50 Meters distance of specified inscription including excavation of soil and making cement concrete foundation as per drawing complete in all respects conforming to specifications.	6	No.		
3.	Providing, installing, testing & commissioning of KIOSK type 500 kVA Sub-station (02 Incoming + 01 Outgoing) in steel sheet clad housing, comprising of following;				
3.1	**H.T Portion** **Incoming** **02** - 11 kV Fused Load Break Switch (LBS) Panel, comprising of following accessories;				
	a) 02 - TP, fused LBS 630A, 25kA, make: Areva with 03 Nos. High Tension HRC Fuses with tripping arrangement (01 No. for each I/C Panel). **b) 06** - Potential Transformer make: PEL (03 Nos. for each I/C Panel). **c) 02** - P.T operated Voltmeter (Digital) with phase Selector Switch make: Lumel/Zeigler (01 No. for each I/C Panel). **d) 02** - Ammeter (Digital) with Phase Selector Switch Make: Lumel/Zeigler (01 No. for each I/C Panel). **e) 06** - Current Transformer (25/5/5A~250/5/5A) make: PEL (03 Nos. for each I/C Panel). **f) 02** - Capacitor Trip Unit, make: E-Lab (01 No. for each I/C Panel). **g) 04** - ON/OFF Indication Lights, make: Telemecanique, China (02 Nos. for each I/C Panel). **h) 06** - SP, MCB, 6A (for control), make: Terasaki, Japan (03 Nos. for each I/C Panel). **i) 02** - TP, MCB, 6A, (for Control), make: Terasaki, Japan (01 No. for each I/C Panel). **j) 12** - Insulators, Make: G.J. Malaysia (06 Nos. for each I/C Panel). **k) 02** - Anti-Condensation Heater, make: E-Lab (01 No. for each I/C Panel). **l) 06** - Surge Arrestors, make: CPS (03 Nos. for each I/C Panel).				

	Outgoing **01** - 11kV Fused Load Break Switch (LBS) Panel, comprising of following accessories; **a) 01** - TP, fused LBS, 630A, 25kA, make Areva with 03 Nos. High Tension HRC Fuses with tripping arrangement. **b) 03** - Potential Transformer, make: PEL. **c) 01** - P.T operated Voltmeter (Digital) with Phase Selector Switch, make: Lumel/Zeigler. **d) 01** - Ammeter (Digital) with phase Selector Switch, make: Zeigler/Lumel. **e) 03** - Current Transformer (25/5/5A~250/5/5A), make: PEL) **f) 01** - Auxiliary Relay for Alarm & Trip indication. **g) 01** - Capacitor Trip Unit, make: E-Lab. **h) 02** - ON/OFF indication lights, make: Telemechanique, China **i) 01** - Buzzer, make: Kacon **j) 03** - SP, MCB, 6A, (for control), make: Terasaki, Japan **k) 01** - TP, MCB, 6A (for control), make: Terasaki, Japan. **l) 06** - Insulators, make: G.J. Malaysia				
3.2	**01 - 500 kVA**, 11,000/415V, Oil Cooled Transformer (copper winding on Primary & Secondary side) as per specifications and with (single tripping only) Float Buchholz Relay, make: PEL.				
3.3	**L.T Portion** **01** - L.T Panel for 500 kVA KIOSK Sub-station, comprising of following accessories; **Incoming** **a) 02** - TP, MCCB, rated at 1600A (800~1600A), 85kA make Terasaki with OC and S/C trips and ON/OFF indication (01 No. for T/F & 01 No. for Diesel Generator). **b) 04** - Auxiliary Switch (1C) for item No. 3.3 (a), make: Terasaki, Japan. **c) 02** - UVT Relay for item No. 3.3 (a) **d) 01** - Mechanical Interlock for item No. 3.3 (a), make PEL. **e) 02** - Voltmeter (Digital), make: Entes/Lovato. **f) 02** - Voltmeter Selector Switch **g) 02** - Ammeter (Digital), make: Entes/Lovato. **h) 02** - Ammeter Selector Switch **i) 06** - Current Tranformer 1200/5~2000A, CTRL-3, TAR-6, make: PEL/Revalco. **j) 06** - Phase Indication Lamps, make: Lovato/Telemecanique. **k) 04** - ON/OFF Indication Lights, make: Lovato/Telemecanique. **l) 06** - SP Control MCB 6A, make: Terasaki, Japan.				

	Outgoing **a) 02** - TP, MCCB, 630A (250~630), 36 kA, make: Terasaki, Japan. **b) 04** - TP, MCCB, 400A (250~400), 36 kA, make: Terasaki, Japan. **c) 02** - TP, MCCB, 250A (160~250), 36 kA, make: Terasaki, Japan.	1	Job		
4.	Supply of High Tension HRC fuses of appropriate rating as spares for 500 kVA KIOSK Sub-Station.	3	No.		
5.	Making RCC base for sub-station 2' height from ground level and suitable space around the substation and fixing and installation & testing and commissioning of the substation etc., complete in all respects.	1	Job		
6.	Providing, making and testing of earth point for H.T. Panel/L.T Panel body with 24"x24"x1/8" copper plate buried 15 feet deep in ground or 1 foot below the depth of permanent water level whichever is less, covered with charcoal and lime in specified ratio. (H.T = 02 x I/C, 01 x O/G, L.T = 01 x O/G)	4	Job		
7.	Providing, making and testing of earth point for transformer neutral with 48"x48"x1/8" copper plate buried 15 feet deep in ground or 1 foot below the depth of permanent water level whichever is less, covered with charcoal and lime in specified ratio and to specification.	1	Job		
8.	Providing , laying, connection and testing 2-16 mm² stranded bare copper conductor in ¾" dia PVC Pipe from H.T. Panel/L.T. Panel body and transformer neutral to earth plate compete with all accessories and fasteners.	5	Job		
9.	Providing, laying, connecting and testing of copper earth terminal blocks of appropriate size for connecting earth conductor to the Transformer neutral and H.T/L.T Panel body.	5	Job		
	Total Amount of SECTION-1 - Non-Schedule Items in Rs.				

Amount carried over to summary at serial no - 1, Page- no:147

Section No. 02: SHIFTING OF S/S NO.06 FOR NEW GIRLS' HOSTEL
[Non-Scheduled Items]

S.No.	ITEM DESCRIPTION	QTY	UNIT	RATE (Rs)	TOTAL AMOUNT (Rs)
1.	Repair & General Maintenance of S/S No. 06 - 150kVA KIOSK type Sub-Station, L.T Panel, Transformer Oil, & Oil Paint Colour, Locking arrangement repair as per instruction of Engineer Incharge.	1	Job		
2.	Providing, laying, connecting, testing and commissioning of 11 kV, 3 core, 16 mm sq. XLPE copper conductor unarmored cable to be laid from Sub-station S/S-04 to New Girls' Hostel Sub-Station, complete making of trench, cable warning tiles as per specifications.	200	Mtr.		
3.	Making RCC base for sub-station 2' height from ground level and suitable space around the substation and fixing and installation & testing and commissioning of the substation etc., complete.	1	Job		
4.	Providing, making and testing of earth point with 24"x24"x1/8" copper plate buried 15 feet deep in ground or 1 foot below the depth of permanent water level whichever is less, covered with charcoal and lime in specified ratio.				
	a) for Transformer Neutral b) for H.T. Panel/ L.T. Panel body	2	Job		
5.	Providing , laying, connecting and testing 16 mm² stranded bare copper conductor in ¾" dia PVC Pipe from transformer neutral and L.T Panel body to earth plate compete with all accessories and fasteners.	2	Job		
6.	Providing, laying, connecting and testing of copper earth terminal blocks of appropriate size for connecting earth conductor to the Transformer neutral and L.T Panel body.	2	Job		
	Total Amount of SECTION-2 - Non Schedule Items in Rs.				

Amount carried over to summary at serial no - 2, Page- no:147

Section No. 03: STREET POLE LIGHTING (GYMNASIUM & STUDENT SERVICE CENTER)
[Scheduled Items]

S.No.	ITEM DESCRIPTION	QTY	UNIT	RATE (Rs)	TOTAL AMOUNT (Rs)
1.	Providing & fixing of MS Tubular pole 31 ft long buried in the ground as per following specifications; 20 ft (6" dia) × 5.5 ft (5" dia) × 5.5 ft (4" dia) = 31 ft Wall thickness 8 SWG Base Plate 16" × 16" × ¼" Two (02) coats of red oxide as rust preventive Two (02) coats of oil paint Excavation of hard/soft soil 2' × 2' × 6' Lean size 2' × 2' × 6" with 1:4:8 ratio CC work 1:3:6 cast in situ in one mould of (1½' dia) including form work, rodding, curing, etc. complete with CC collor about 2ft high from ground level duly plastered as per site requirement & instruction of EI. (ESI # 137, Page # 17)	69	Job	26,956.00	1,859,964.00
2.	Manufacturing, providing & fixing GI single arm double arch as per site requirement & instruction of EI with following specifications; GI Pipe 2" dia 10 SWG 5ft long 2 Nos. MS clamps with nuts & bolts (ESI # 143, Page # 21)	69	Job	1,546.00	106,674.00
3.	Providing & Fixing of flood light 250 watts (HPIT) having IP-65 classification with 250W lamp, choke, capacitor, ignitor & internal wiring complete in all respect, on ground as per drawings with the help of manual labour and as per instruction of EI. (ESI # 165, Page # 26). Make: Philips/Pierlite.	18	No.	15,440.00	277,920.00
				Total of Schedule Items (A)	**2,244,558.00**

I the Contractor M/s _____

Hereby quote _____ premium above/below on the schedule items. **(B)=** _____

Total Amount of SECTION-3 Schedule Items (A+B) in Rs. _____

Amount carried over to summary at serial no - 3, Page- no:147

Section No. 04: STREET POLE LIGHTING (GYMNASIUM & STUDENT SERVICE CENTER)
[Non-Scheduled Items]

S. #.	Item Description	Qty.	Unit	Unit Price (Rs.)	Total Amount (Rs.)
1.	Providing, installing of 16SWG sheet steel terminal box with steel hinged door covered locking arrangement comprising of 5/10 amps. miniature circuit breaker, connectors etc. including making connections with the incoming and outgoing cables. Complete in all respects as per sketch and drawing conforming to specifications. (for 69 Nos. street lights & 18 Nos. Flood Lights)	87	No.		

2.	Providing, Installing and connecting of Street Light **250W MH-T / HPI-T Lamp** fitting, Model: Road Master 250W MH / Velocity SGP338 GB ALU, Make: **Pierlite / Philips** or equivalent as approved by E.I having IP65 c/w Integral Control Gear including Ballast, Capacitor, Ignitor & Internal Wiring for 250W MH-T / HPI-T Lamp complete in all respect at the height of 31ft with the help of hydraulic crane or manual labour as per site requirement.	69	No.		
	Total Amount of SECTION-4 - Non Schedule Items in Rs.				

Amount carried over to summary at serial no - 4, Page- no:147

Section No. 05: DISTRIBUTION BOARDS & CABLES
[Scheduled Items]

S. #.	Item Description	Qty.	Unit	Unit Price (Rs.)	Total Amount (Rs.)
1.	Proving, installing, connecting & commissioning of the following Distribution Board (D.B) fabricated of 14 SWG steel clad sheet, cubical design with hinged door cover, floor mounted, factory assemebled, suitable for 3-Phase, 4 wrie, 500 volts, 50 Hz A.C Power Supply. Compplete with, pure copper busbars, copper cable lugs, glands, neutral link, earth block, terminal block etc. &				
	having following configurations. (All equipment rated to 15kA short circuit rating and 50 °C ambient temperature at 415V). Panel enclosure to amply with IP-50.				
1.1	**D.B-SL**				
	Incoming				
	01 - 50A, T.P MCCB (XS-100NS). (ESI # 207, Page # 31)	1	No.	9,261.00	9,261.00
	03 - Providing & fixing Digital Ammeter size 96/96 mm direct 100A as required & as per instruction of EI. (ESI # 284, Page # 41)	3	No.	1,054.00	3,162.00
	01 -Providing & fixing Digital Voltmeter size 96/96 mm 500V as required & as per instruction of EI. (ESI # 285, Page # 41)	1	No.	999.00	999.00
	Outgoing				
	08 - 20A, S.P, MCB (TB-5S). (ESI # (203, Page # 31)	8	No.	916.00	7,328.00
2.	Providing, laying and connecting of the following cables laid in ground or in PVC pipe wherever required at road crossing or as shown in the drawing from the Sub-Station to the Distribution Box for Street Lights as shown in the drawings. The job includes excavation and back filling of earth, providing and laying cable warning tiles etc. complete with all accessories required conforming to specifications.				
2.1	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 4 core copper conductor 600/1000 volts size **16mm²**. (ESI # 102, Page # 12) - (From S.Stn. to D.B)	65	Mtr.	1,300.00	84,500.00

3.	Providing, laying and connecting of the following cables laid in ground or in PVC pipe wherever required at road crossing or as shown in the drawing from the Sub-Station to Cable Terminal Box for Street Lights as shown in the drawings. The job includes excavation and back filling of earth, providing and laying cable warning tiles etc. complete with all accessories required conforming to specifications.				
3.1	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 2 core copper conductor 300/500 volts size **6 mm²**. (ESI # 62, Page # 08) - (01 ckt. from D.B to Cable Terminal Box as per drawings)	165	Mtr.	233.00	38,445.00
3.2	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with 2 core copper conductor 300/500 volts size **10 mm²**. (ESI # 63, Page # 08) - (03 ckts. from D.B to Cable Terminal Box as per drawings)	1,000	Mtr.	375.00	375,000.00
3.3	Providing & laying (Main or Sub Main) PVC insulated & PVC sheathed with Single core copper conductor 300/500 volts size 2-7/0.064" (**16 mm²**). (ESI # 57, Page # 07) - (04 ckts. from D.B to Cable Terminal Box as per drawings)	1,500	Mtr.	524.00	786,000.00
4.	Providing & laying (MAIN or SUB-MAIN) PVC insulated with size 2-3/0.029" copper conductor in ¾" dia PVC conduit recessed in the wall or column as required. (ESI # 08, Page # 02). *NOTE: From cable terminal boxes to the lighting fixtures (69 Nos. Street Lights & 18 Nos. Flood Lights).*	1,131	Mtr.	173.00	195,663.00
				Total of Schedule Items (A)	**1,500,358.00**

I the Contractor M/s _____

Hereby quote _____ premium above/below on the schedule items. **(B)=** _____

Total Amount of SECTION-5 Schedule Items (A+B) in Rs. _____

Amount carried over to summary at serial no - 5, Page- no:147

Section No. 06: DISTRIBUTION BOARDS & CABLES
[Non-Scheduled Items]

S. #.	Item Description	Qty.	Unit	Unit Price (Rs.)	Total Amount (Rs.)
1.	Proving, installing, connecting & commissioning of the following Distribution Board (D.B) fabricated of 14 SWG steel clad sheet, cubical design with hinged door cover, floor mounted, factory assemebled, suitable for 3-Phase, 4 wrie, 500 volts, 50 Hz A.C Power Supply. Compplete with pure copper busbars, copper cable lugs, glands, neutral link, earth block, terminal block etc. & having following configurations. (All equipment rated to 15kA short circuit rating and 50 °C ambient temperature at 415V). Panel enclosure to comply with IP-50)				

1.1	**D.B-SL** **Incoming** **01** - Voltemeter Selector Switch (7 Steps), PK9054E. Make: K&N (Newzealand) **03** - Phase (R.Y.B) indication lamps, 220V Model: 8LP2T1LM, Make: Lovato (Italy) or Equivalent & as per instruction of EI. **02** - ON/OFF (Green & Red) indication Lights 220V Model: 8LP2T1LM, Make: Lovato (Italy) or Equivalent & as per instruction of EI. **03** - Control fuse with base 2/32A Model: T-0+PM-F, make: DF (Spain) or equivalent as per instruction of EI.	1 1 3 2 3	No. No. No. No. No.		
2.	Providing & Installing connecting of Hard Drawn Copper Wire from Sub-Station to D.B and from DB to Cable Terminal Box in PVC Conduit recessed in RCC or on surface / concealed in ground as required, complete in all respect and entire satisfaction of EI.				
2.1	**D.B-SL** Providing & Laying of Hard Drawn Copper Conductor size **10 mm²** as ECC. With wiring of DB-SL in 1.5" dia rigid PVC conduit burried in ground/floor. (01 ckt. from Sub-Station to DB)	65	Mtr.		
2.2	Providing & Laying of Hard Drawn Copper Conductor size **4 mm²** as ECC. With wiring of DB-SL in 3/4" dia rigid PVC conduit burried in ground/floor. (01 ckts. from DB to Cable terminal boxes)	165	Mtr.		
2.3	Providing & Laying of Hard Drawn Copper Conductor size **6 mm²** as ECC. With wiring of DB-SL in 1¼" dia rigid PVC conduit recessed in wall/column or ground/floor. (03 ckts. from DB to Cable terminal boxes)	1,000	Mtr.		
2.4	Providing & Laying of Hard Drawn Copper Conductor size **10 mm²** as ECC. With wiring of DB-SL in 1¼" dia rigid PVC conduit burried in ground/floor. (04 ckts. from DB to Cable terminal boxes)	1,500	Mtr.		
	Total Amount of SECTION-6 - Non Schedule Items in Rs.				

Amount carried over to summary at serial no - 6, Page- no:147

MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO - SINDH - PAKISTAN

EXTERNAL DEVELOPMENT
FOR
STUDENT SERVICE CENTER & GYMNASIUM

CONSULTANTS ELECTRICAL DESIGN DRAWINGS
FOR
STREET LIGHTS

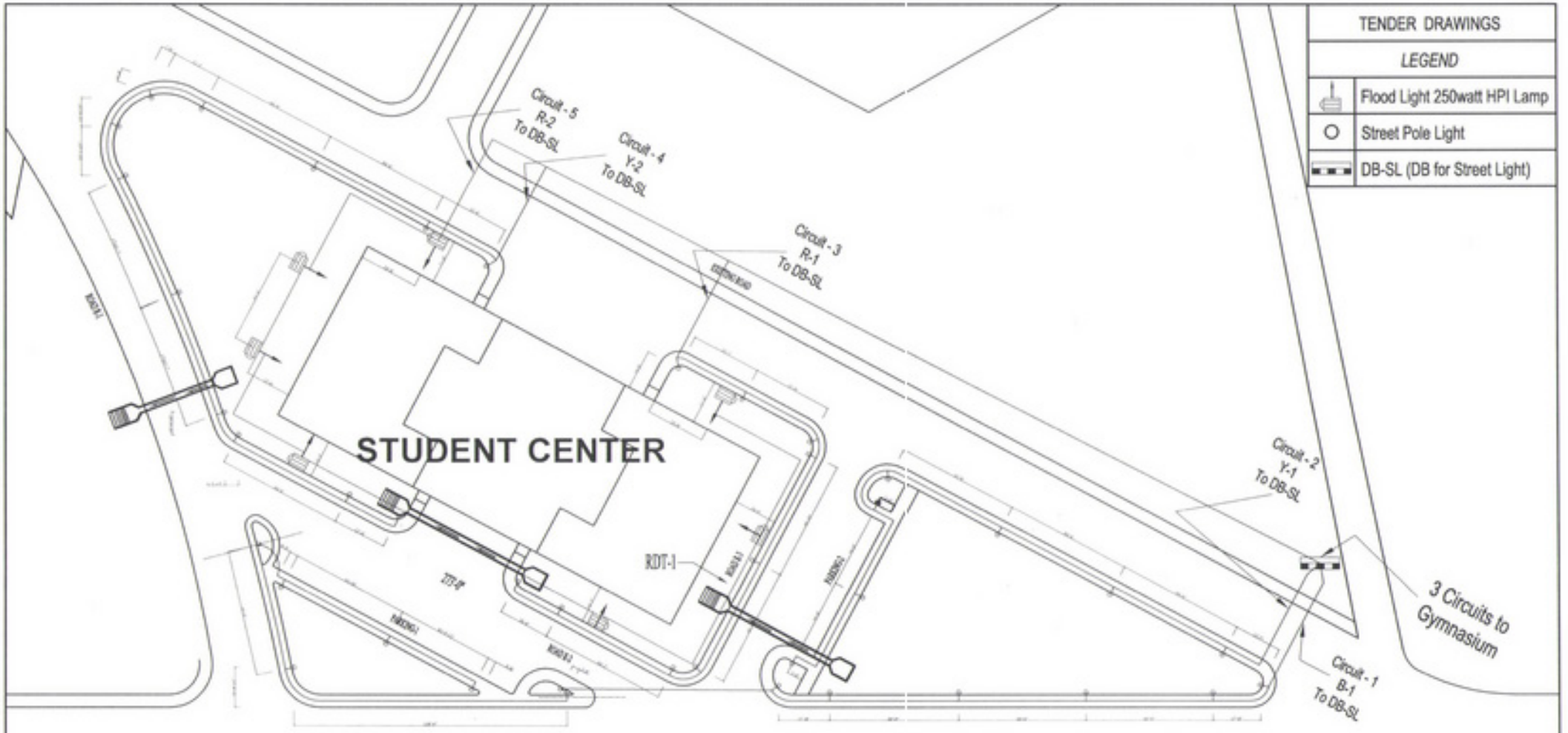
NAQVI AND SIDDIQUIE
INC.ARCHITECTS & ENGINEERS
BLOCK NO. 18 FIRST FLOOR
MARKAZ F -6
ISLAMABAD
TEL 051-2876769-2270268

KAD CONSULTANTS
ELECTRICAL ENGINEERS
F-1, ZAIB RESIDENCY, HUSSAIN HOUSING SCHEME, NEAR SUMMIT BANK, WADHU WAH, QASIMABAD (PHASE-1), HYDERABAD.
CELL: +92 334 9377556.
TEL: +92 22 2652274, FAX: +92 22 2652275,
E-MAIL: kad.consultants@hotmail.com

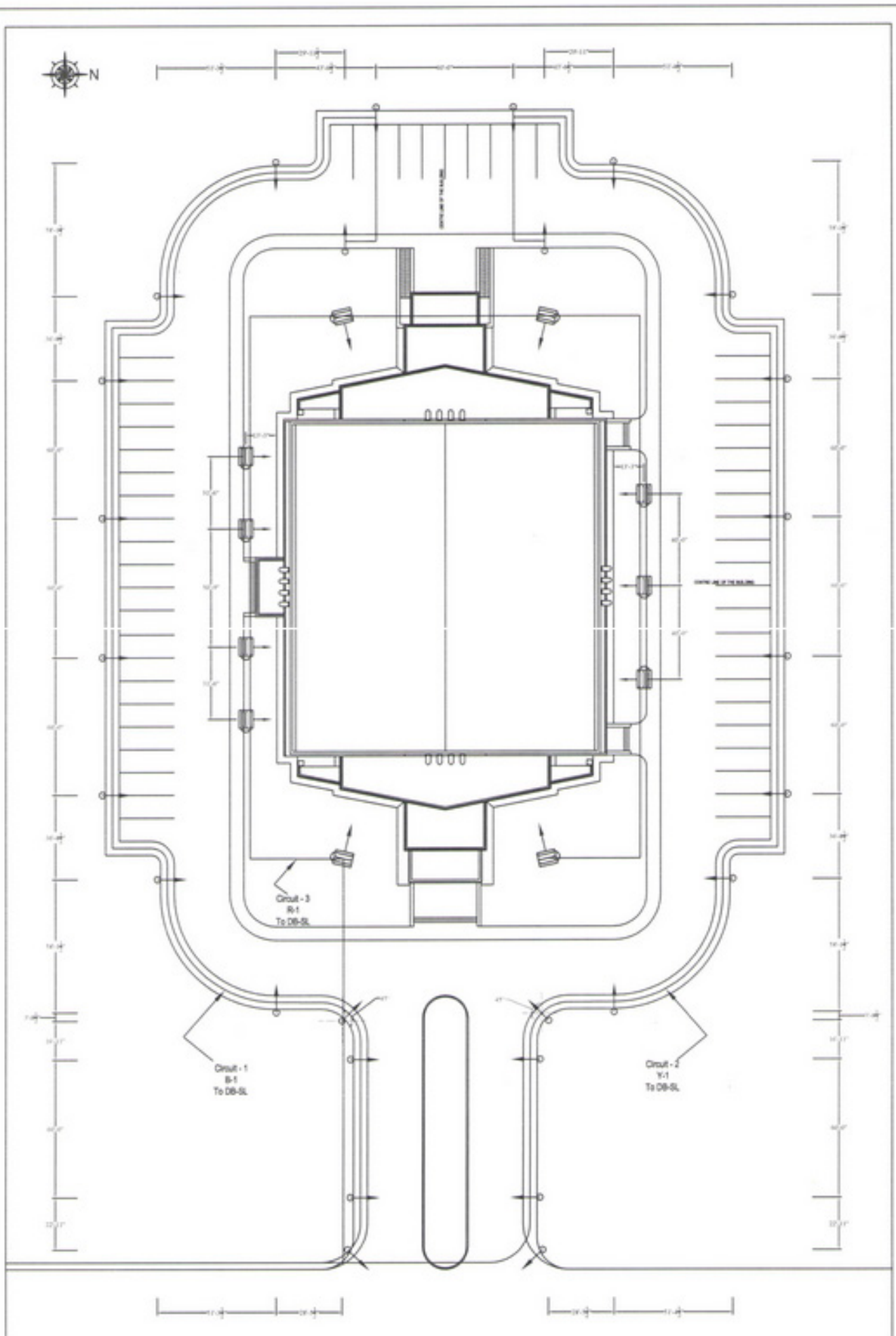
STREET LIGHTING
FOR
STUDENTS SERVICE CENTER & GYMNASIUM
MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY
JAMSHORO

LIST OF DRAWINGS

S.NO	DRWG.NO	TITLE	REMARKS
1.	E-01	STREET LIGHTING & FLOOD LIGHTING LAYOUT - STUDENT SERVICE CENTER, MUET, JAMSHORO	REV. 0
2.	E-02	STREET LIGHTING & FLOOD LIGHTING LAYOUT - GYMNASIUM, MUET, JAMSHORO	REV. 0
3.	E-03	LAYOUT FOR LOCATION OF DISTRIBUTION BOARD FOR STREET LIGHTS, MUET, JAMSHORO	REV. 0
4.	SC-E-01	SCHEMATIC DIAGRAM DISTRIBUTION BOARD - STREET LIGHTS	REV. 0

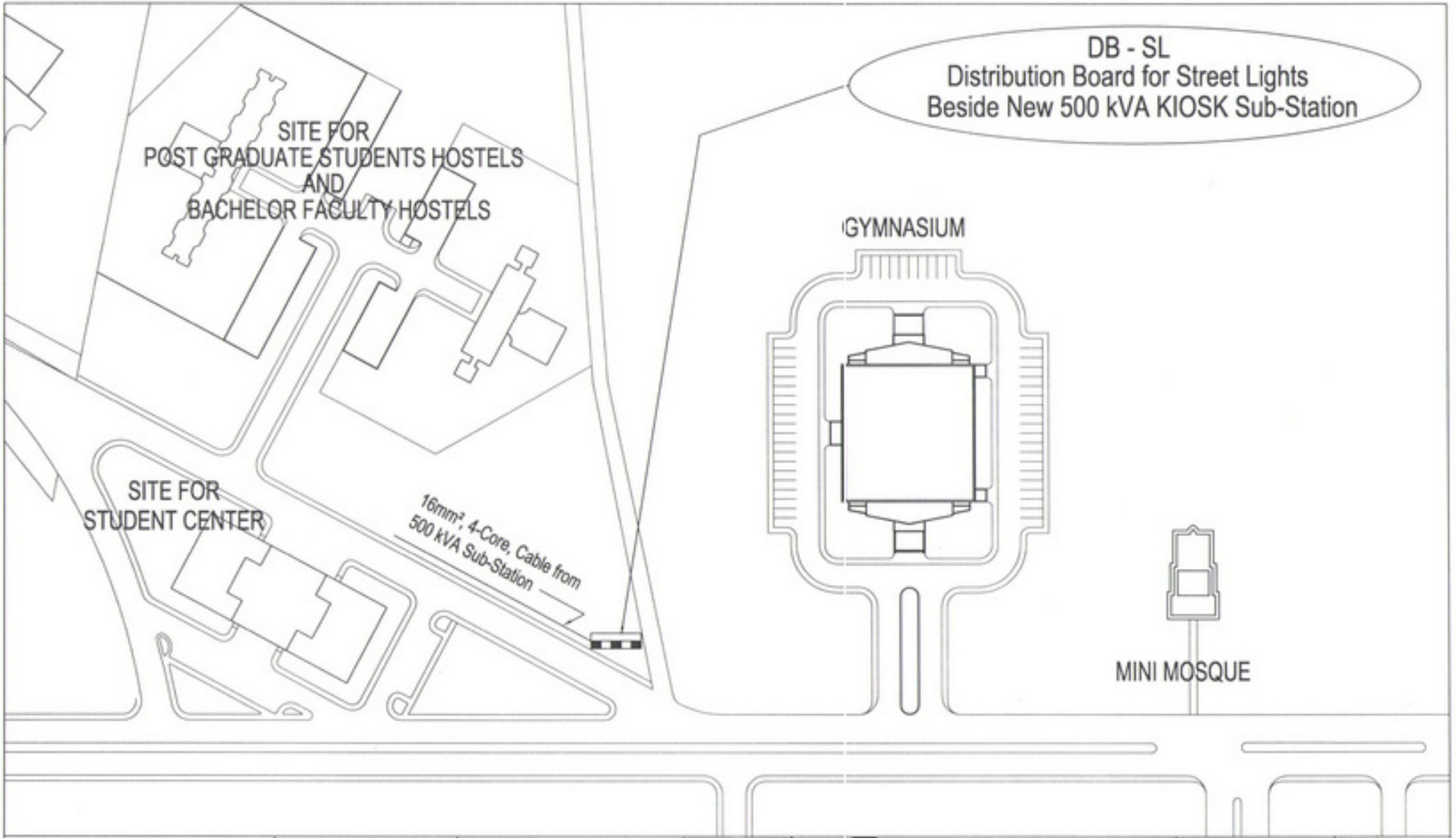


PROJECT: STREET LIGHTING STUDENT SERVICE CENTER & GYMNASIUM MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO	TITLE STREET LIGHTING & FLOOD LIGHTING LAYOUT - STUDENT SERVICE CENTER, MUET, JAMSHORO	ARCHITECTS NAQVI AND SIDDIQUE INC. ARCHITECTS AND ENGINEERS BLOCK NO 18, 1 ST : FLOOR MASJID SUPER MARKET MARKAZ F-6. ISLAMABAD		KAD CONSULTANTS ELECTRICAL ENGINEERS F-1, ZAIB RESIDENCY, HUSSAIN HOUSING SCHEME, NEAR SUMMIT BANK, WADHU WAH, QASIMABAD (PHASE 1), HYDERABAD TEL. +92 22 2652274, FAX. +92 22 2652275 CELL. +92 334 9377596 E-MAIL. kad.consultants@hotmail.com	DESIGNED BY: ENGR: SANAULLAH MEMON DRAWN BY: ENGR: SANAULLAH MEMON SCALE: N.T.S DATE 26-02-2014	PROJECT NO: 019/14 DRAWING NO: E-01



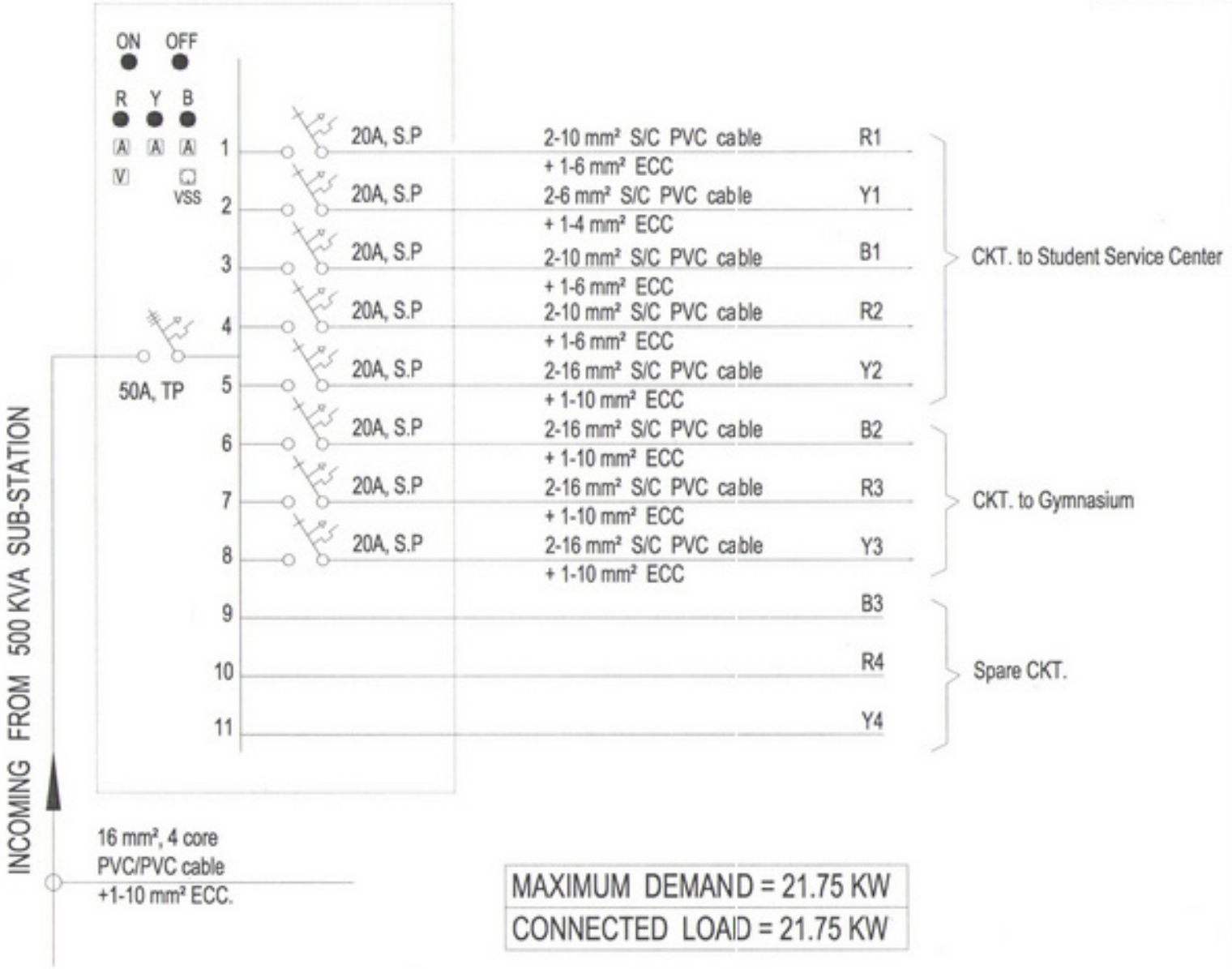
Flood Light 250Watt HPI Lamp	Street Pole Light	TENDER DRAWINGS	

PROJECT: STREET LIGHTING STUDENT SERVICE CENTER & GYMNASIUM MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO	TITLE STREET LIGHTING & FLOOD LIGHTING LAYOUT - GYMNASIUM, MUET, JAMSHORO	ARCHITECTS NAQVI AND SIDDIQUE INC. ARCHITECTS AND ENGINEERS BLOCK NO. 16, 1 ST. FLOOR MAGAD SUPER MARKET MARAZ 1-6 ISLAMABAD	KAD CONSULTANTS ELECTRICAL ENGINEERS [illegible]	DESIGNED BY: ENGR. SANAULLAH MEMON DRAWN BY: ENGR. SANAULLAH MEMON SCALE: N. T. S DATE: 25-02-2014	PROJECT NO: 219/14 DRAWING NO: E-02



PROJECT: STREET LIGHTING STUDENT SERVICE CENTER & GYMNASIUM MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO	**TITLE** LAYOUT FOR LOCATION OF DISTRIBUTION BOARD FOR STREET LIGHTS, MUET, JAMSHORO	**ARCHITECTS** NAQVI AND SIDDIQUE INC. ARCHITECTS AND ENGINEERS BLOCK NO 18, 1 ST : FLOOR MASJID SUPER MARKET MARKAZ F-6, ISLAMABAD		**KAD CONSULTANTS** ELECTRICAL ENGINEERS F-1, ZAIB RESIDENCY, HUSSAIN HOUSING SCHEME, NEAR SUMMIT BANK, WADHU WAH, QASIMABAD (PHASE-1), HYDERABAD TEL: +92 22 2652278, FAX +92 22 2652275, CELL +92 334 9377506 E-MAIL: kad.consultants@hotmail.com	DESIGNED BY: ENGR: SANAULLAH MEMON DRAWN BY: ENGR: SANAULLAH MEMON SCALE: N.T.S DATE 25-02-2014	PROJECT NO: 019/14 DRAWING NO: E-03

TENDER DRAWINGS



MAXIMUM DEMAND = 21.75 KW

CONNECTED LOAD = 21.75 KW

DB - SL

PROJECT:	TITLE	ARCHITECTS			
STREET LIGHTING STUDENT SERVICE CENTER & GYMNASIUM MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO	SCHEMATIC DIAGRAM DISTRIBUTION BOARD - STREET LIGHTS	NAQVI AND SIDDIQUE INC. ARCHITECTS AND ENGINEERS BLOCK NO 18, 1ST FLOOR MASJID SUPER MARKET MARKAZ F-6, ISLAMABAD	KAD CONSULTANTS ELECTRICAL ENGINEERS F-11, DAR-E-SIDDIQUE HUSSAIN HOUSING SCHEME, NEAR SUMMIT BANK, WAQFI MAH, GADAMBAD (PHASE-I), HYDERABAD. TEL: +92 22 2652374, FAX: +92 22 2652375, CELL: +92 334 9377556 E-MAIL: kad.consultants@hotmail.com	DESIGNED BY: ENGR. SANAULLAH MEMON DRAWN BY: ENGR. SANAULLAH MEMON SCALE: N. T. S DATE 25-02-2014	PROJECT NO: 019/14 DRAWING NO: SC-E-01