PUNJAB INDUSTRIAL ESTATES DEVELOPMENT AND MANAGEMENT COMPANY (PIEDMC)

Bidding Documents

For

"CONSTRUCTION OF PANEL ROOM AND SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF H.T EQUIPMENT FOR 2 NO 11 KV ELECTRICAL CONNECTIONS (0.98 MW EACH) OF STITCHING UNITS (PLOT NO 09 A TO 12A) AT QUAID-E-AZAM BUSINESS PARK (QABP), SHEIKHUPURA"

ITB # PIE/P&C/11KV/QABP/25/13

Volume I : Bidding Documents

March 2025

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INVITATION
FOR BIDS

INVITATION FOR BIDS

Date: _____

1. PIEDMC intends to hire a Contractor for construction of panel room and supply, installation, testing and commissioning of H.T equipment for 2 No. 11 KV electrical connections (0.98 MW each) of stitching units (plot No. 09A to 12A) at Quaid-e-Azam Business Park (QABP), Sheikhupura.

2. Sealed Bids are invited for the above said work from Contractors registered with PEC in category C- 4 with specialized codes CE-10, EE-04, EE-05 & EE-11 having experience of similar works.

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

4. Bidding Documents are available on PPRA website: www.ppra.punjab.gov.pk, PIEDMC website www.pie.com.pk and EPADS Portal **i.e.** http://punjab.eprocure.gov.pk free of cost.

5. Technical and Financial Separate bids, duly completed, signed, stamped and in complete conformity with **Bidding Documents must be submitted online E-Pak Acquisition and Disposal System (EPADS) Portal i.e. http://punjab.eprocure.gov.pk till 7th April, 2025 by or before 03:00 PM and bids shall be opened at same date on 03:30 PM, as per the PPRA Rules, 2014**

6. Bid must contain Bid Security in shape of Bank Guarantee / CDR / Bank Draft / Pay Order amounting to Rs. 1,617,317/- in favor of "PIEDMC" (which is 2% of the estimated cost), without which the offer shall be rejected being non-responsive. The bid security must be attached in PDF format and submitted in original in Chief Engineer (P&C) office, before bid opening.

7. Bids that are incomplete, not signed and stamped, late, or submitted by other than specified mode will not be considered.
8. For bids submission on E-procurement, Bidders are requested to register at www.punjab.eprocure.gov.pk.
9. In case, the firm is found Black-listed by PIEDMC and PPRA or provide false / misleading information, it's Bid will be cancelled and will be recommended for punitive action.

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

Your Faithfully
Chief Engineer (P&C)

INSTRUCTIONS
TO
BIDDERS

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INSTRUCTIONS TO BIDDERS

A. GENERAL

IB.1 Scope of Bid and Source of Funds

1.1 Scope of Bid

Punjab Industrial Estates Development And Management Company PIEDMC (hereinafter called "the Employer") wishes to receive bids for the following scope of work:

CONSTRUCTION OF PANEL ROOM AND SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF H.T EQUIPMENT FOR 2 NO. 11 KV ELECTRICAL CONNECTIONS (0.98 MW EACH) OF STITCHING UNITS (PLOT NO. 09A TO 12A) AT QUAID-E-AZAM BUSINESS PARK (QABP), SHEIKHUPURA

Bidders must quote for the complete scope of work. Any bid covering partial scope of work will be rejected as non-responsive, pursuant to Clause IB.24.

1.2 **Source of Funds**

The Employer has enough funds and intends to use part of it to eligible payments under the Contract for which these Bidding Documents are issued.

IB.2 Eligible Bidders

2.1 Bidding is open to all firms and persons meeting the following requirements (Documentery evidence to be provided):

a) duly licensed by the Pakistan Engineering Council (PEC) in Category **C-4** or above with specialized codes CE-10, EE-04, EE-05 & EE-11.

b) from eligible countries listed in Appendix 'A' to Instruction to Bidders.

c) NTDC/LESCO/WAPDA Approved Contractor.

d) Registered with FBR with Income Tax and Sales Tax.

e) Not be Blacklisted with PIEDMC & PPRA.

f) Must have at least 05 years experience of works of similar nature and complexity.

IB.3 Eligible Goods and Services

3.1 All Goods and ancillary Services to be supplied under this Contract shall have their origin in eligible countries listed in Appendix 'A' to Instructions to Bidders and all expenditures made under the Contract will be limited to such Goods and Services.

3.2 For purpose of this Clause, "origin" means the place where the Goods are mined, grown or produced or from where the ancillary services are supplied. Goods are

produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

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

IB.4 Cost of Bidding

4.1 The bidder shall bear all costs associated with the preparation and submission of its bid and the Employer will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

B. BIDDING DOCUMENTS

IB.5 Contents of Bidding Documents

5.1 In addition to Invitations for Bids, the Bidding Documents are those stated below, and should be read in conjunction with any Addendum issued in accordance with Clause IB.7.

1. Instructions to Bidders with Appendices
2. Form of Bid & Schedules to Bid

   Schedules to Bid are the following:

   (i) Schedule A: Specific Works Data
   (ii) Schedule B: Work to be Performed by Subcontractors
   (iii) Schedule C: Proposed Programme of Works
   (iv) Schedule D: Deviations from Technical Provisions
   (v) Schedule E: Deviations from Contractual Conditions
   (vi) Schedule F: Method of Performing Works
   (vii) Schedule G: Proposed Organisation
   (viii) Schedule H: Integrity Pact
   (ix) Schedule I: List of Major Equipment
   (x) Schedule J: Camp Office of Contractor
   (xi) Schedule K: List of Subcontractors

3. Schedule of Prices
4. Preamble to Conditions of Contract
5. General Conditions of Contract
6. Particular Conditions of Contract
7. Standard Forms
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   (i) Form of Bid Security
   (ii) Form of Contract Agreement
   (iii) Form of Performance Security
   (iv) Form of Bank Guarantee/Bond for Advance Payment
8. Specifications - Special Provisions

9. Specifications - Technical Provisions
10. Drawings

5.2 The bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of bid submission will be at the bidders own risk. Pursuant to Clause IB.24, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.6 Clarification of Bidding Documents

6.1 A prospective bidder requiring any clarification(s) in respect of the Bidding Documents may notify through **EPADS**

The Engineer will examine the request for clarification of the Bidding Documents which it receives not later than ten (10) days prior to the deadline for the submission of bids and if needed will issue the clarification/amendment of the Bidding Documents at least Five (05) days before the date of submission of Bids (without identifying the source of enquiry) to all prospective bidders who have download the Bidding Documents.

IB.7 Amendment of Bidding Documents

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

7.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 7.1 hereof, and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Employer. The bidder shall also confirm in the Form of Bid that the information contained in such addenda have been considered in preparing his bid.

7.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may at its discretion extend the deadline for submission of bids in accordance with Clause IB.19.

C. PREPARATION OF BIDS

IB.8 Language of Bid

8.1 The Bid prepared by the Bidder and all correspondence and documents relating to the Bid, exchanged by the Bidder and the Engineer shall be written in the English language, provided that any printed literature furnished by the Bidder may be written in another language so long as accompanied by an English translation of its pertinent passages in which case, for purposes of interpretation of the Bid, the English translation shall govern.

IB.9 Documents Comprising the Bid

9.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid and the other the Price Bid, containing the documents listed below. Both envelopes to be enclosed together in an outer single envelope called the Bid. Each bidder shall furnish all the documents as specified in the list below.

The bid prepared by the bidder shall comprise the following components:

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

- Letter of Price Bid
- Bid Security furnished in accordance with Clause IB.15.
- Schedule of Prices completed in accordance with Clauses IB.11 and 12.
- Power of Attorney in accordance with Clause IB 17.5.
- Pending Litigation information
- Organization Chart for Supervisory Staff
- Schedules (A to K) to Bid duly filled and signed, in accordance with the instructions contained therein.
- Joint Venture Agreement (if applicable).
- Documentary evidence established in accordance with Clause IB.13 that the bidder is eligible to bid and is qualified to perform the contract if its bid is accepted. (Appendix-B)
- Documentary evidence established in accordance with Clause IB.14 that the Goods and ancillary Services to be supplied by the bidder are eligible Goods and Services and conform to the Bidding Documents. (Appendix A along with schedule A)
- Any other documents prescribed in Particular Conditions of Contract or Technical Provisions to be submitted with the bid.

9.2 Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the bid, together with a copy of the proposed agreement. The role to be played by each partner to be specified therein. Bids submitted by a joint venture of two (2) or more firms shall comply with the following requirements:

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

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

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

(d) All partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub-Para (b) above as well as in the Form of Bid and in the Form of JV Agreement (in case of a successful bid); and

(e) A copy of JV agreement shall be submitted before signing of the Contract, stating the conditions under which JV will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. The JV Agreement shall be made part of the contract. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partners without prior written consent of the Employer.

The Bidder shall furnish, as part of the Technical Bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidders‟ proposal to meet the work requirements and the completion time referred to in the Preamble to Conditions of Contract.

IB.10 Form of Bid and Schedules

10.1 The bidder shall complete, sign and seal the Form of Bid, Schedules to Bid and Schedule of Prices furnished in the Bidding Documents and shall also enclose other information as detailed in Clause IB.9.

IB.11 Bid Prices

11.1 The bidder shall fill up the **Schedule of Prices** attached to these documents indicating the unit rates and prices of the Works to be performed under the Contract. Prices on the Schedule of Prices shall be entered keeping in view the instructions contained in the Preamble to the Schedule of Prices.

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

11.3 The bidder's separation of price components in accordance with Sub-Clause 11.1 above, will be solely for the purpose of facilitating the comparison of bids by the Employer/Engineer and will not in any way limit its right to contract on any of the terms offered.

11.4 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. When the bidders are required to quote only fixed price(s) a bid submitted with an adjustable price quotation will be treated as non-responsive and rejected, pursuant to Clause IB.24.

11.5 Any discount offered shall be valid for at least the period of validity of the bid. A discount valid for lesser period shall be considered null and void.

IB.12 Currencies of Bid

Prices shall be quoted by the bidder in ***Pak Rupees Only.***

For Goods and Services which the bidder will supply from within as well as outside Pakistan, the prices shall be quoted by the bidder in the ***Pak. Rupees Only*.**

The currencies of payment shall be as stated in Particular Conditions of Contract ***(Sub-Clause 35.1).***

IB.13 Documents Establishing Bidder's Eligibility And Qualifications (Mandatory)

13.1 Pursuant to Clause IB.9, 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.

13.2 The documentary evidence of the bidder's eligibility to bid shall establish to the Employer's satisfaction that the bidder, at the time of submission of its bid is from an eligible source country as defined under Clause IB.2.

13.3 The documentary evidence of the bidder's qualification to perform the Contract if its bid is accepted, shall establish to the Employer's/Engineer's satisfaction:

(a) that, in the case of a bidder offering to supply Goods under the Contract which the bidder did not manufacture or otherwise produce, the bidder has been duly authorized by the Goods manufacturer or producer to supply the Goods to Pakistan;

(b) that the Bidder/Manufacturer has the financial, technical and production capability necessary to perform the Contract; and

(c) that, in the case of a bidder not doing business within Pakistan the bidder is or will be (if successful) represented by an agent in Pakistan equipped and able to carry out the Supplier's maintenance, repair and spare parts stocking obligations prescribed by the Conditions of Contract and/or Technical Provisions.

13.4 (a) Bidder/Manufacturer must possess and provide evidence of the following experience:

The bidder must have adequate technical capacity and at least Five (05) years experience in works of similar nature and complexity

Documentation regarding the Bidder's experience on previous and current (in hand) similar contracts must accompany with each Bid.

The Bidder shall certify the capacity and capability of the plant (from which Goods are now offered) for manufacturing, quality assurance and testing facilities, qualified man-power and production/delivery of quality materials according to bid specifications and delivery requirements. Besides, such plant should have produced same items for at least **Ten (10)** years and such Goods shall have proven successful in the field for at least **Two (02)** years and the bidder shall submit with the bid all necessary documentation in this regard. The Employer/Engineer will have the right to verify the particulars regarding the plant and other related information furnished with the bid and the joint venture as well as the partners thereof shall be liable for disqualification in the event of any mis-statement/mis-representation on their part.

The bidder shall furnish documentary evidence of qualification on the Form "Evidence of Bidder's Capability" (Appendix B to these Instructions)

EQUIPMENT TO WHICH ACCESS IS AVAILABLE ON DEMAND / NEED

THE APPLICANT MUST HAVE ACCESS/ARRANGEMENT FOR THE FOLLOWING EQUIPMENT WHEN NEEDED AS MENTIONED BELOW. THE UNDER TAKING FOR ACCESS TO ALL THESE EQUIPMENT IS MANDATORY

Sr. No	Equipment
a)	Earth Resistance tester for measurement of the earth resistance, soil resistivity and Ohmic resistances
b)	AC/DC Hi-pot Test 130kV
c)	Instrument transformers polarity tester for verifying winding polarity of current and voltage transformers
d)	Phase sequence indicator 3ν, voltage range 80 to 500V, 50 Hz
e)	High voltage insulation resistance tester (0.5kV-5kV DC output)
f)	Primary Current Injection Test Set (0-2000A)
g)	Secondary Current Injection Test Set
h)	Universal Relay Test Set with complete accessories

13.5 Joint Venture

In order for a Joint Venture to qualify:

(a) At least one of the partners of joint venture shall satisfy the relevant experience criteria specified in Sub-Clause 13.4(a) hereinabove.

(b) All firms comprising the joint venture shall be legally constituted and shall meet the eligibility requirement of Sub-Clause 2.1 hereof.

(c) All partners of the joint venture shall at all times and under all circumstances be liable jointly and severally to Employer for the execution of the entire Contract in accordance with the Contract terms and conditions and a statement to this effect shall be included in the authorization mentioned under para (f) below as well as in the Form of Bid and Form of Contract Agreement (in case of a successful bidder).

(d) The Form of Bid, and in the case of successful bidder, the Form of Contract Agreement, shall be signed so as to be legally binding on all partners.

(e) One of the joint venture partners shall be nominated as being in-charge and this authorisation shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners.

(f) The partner-in-charge shall be authorized to incur liabilities, receive payments and receive instructions for and on behalf of any or all partners of the joint venture.

(g) A copy of the agreement entered into by the joint venture partners shall be submitted with the bid stating the conditions under which it will function, its period of duration, the persons authorized to represent and obligate it and

which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partner without prior written consent of the Employer.

IB.14 Documents Establishing Goods' Eligibility and Conformity to Bidding Documents (Mandatory)

14.1 Pursuant to Clause IB.9, the bidder shall furnish, as part of its bid, documents establishing the eligibility and conformity to the Bidding Documents of all Goods and Services which the bidder proposes to perform under the Contract.

14.2 The documentary evidence of the Goods and Services eligibility shall establish to the Employer's satisfaction that they will have their origin in an eligible source country as defined under Clause IB.3. A certificate of origin issued at the time of shipment will satisfy the requirements of the said Clause.

14.3 The documentary evidence of the Goods and Services' conformity to the Bidding Documents may be in the form of literature, drawings and data and shall furnish:

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

(b) Complete set of technical information, description data, literature and drawings as required in accordance with Schedule A to Bid, Specific Works Data. This will include but not be limited to the following:

(i) A sufficient number of drawings, photographs, catalogues, illustrations and such other information as is necessary to illustrate clearly the significant characteristics such as general construction dimensions and other relevant information about the Goods/Equipments to be furnished.
(ii) Details of offered equipments with capacity and country origin.
(iii) Any other information which is required for evaluation purposes.

(c) A clause-by-clause commentary on Technical Provisions, provided with the Bidding Documents, demonstrating the Goods' and Services' substantial responsiveness to those Specifications or a statement of deviations and exceptions to the provisions of the Technical Provisions as required in Schedule D to Bid.

14.4 For purpose of the commentary to be furnished pursuant to Sub-Clause 14.3(c) above, the Bidder shall note that standards for workmanship, material and equipment, and references to brand names or catalogue numbers, designated by the Engineer in the Technical Provisions are intended to be descriptive only and not restrictive. The bidder may substitute alternative standards, brand names and/or catalogue numbers in its bid, provided that it demonstrates to the Engineer's satisfaction that the substitutions are substantially equivalent or superior to those designated in the

Technical Provisions. Copies of the standards proposed by the bidder other than those specified in the Bidding Documents shall be furnished.

IB.15 Bid Security (Mandatory)

15.1 Each bidder shall furnish, as part of his bid, a Bid Security in the amount of Pak. Rupees 1,617,317/- (Pak Rupees One Million Six Hundred Seventeen Thousand Three Hundred Seventeen Only) in favour of PIEDMC.

15.2 The Bid Security shall be, at the option of the bidder, in the form of Bank Guarantee / Deposit at Call / Pay Order from a Scheduled Bank in Pakistan in favour of PIEDMC.

15.3 The Bid Security is required to protect the Employer against the risk of bidder's conduct which would warrant the security's forfeiture, pursuant to Sub-Clause 15.7 hereof.

15.4 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Employer as non-responsive, pursuant to Clause IB.24.

15.5 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 which ever is earlier.

15.6 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security, pursuant to Clause IB.34 and signed the Contract Agreement, pursuant to Clause IB.35.

15.7 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 24.2 hereof; or

(c) in the case of a successful bidder, if he fails to:

(i) furnish the required Performance Security in accordance with Clause IB.34, or

(ii) sign the Contract Agreement, in accordance with Clause IB.35.

IB.16 Validity of Bids

16.1 Bids shall remain valid for **120** Days after the date of bid opening as prescribed in Clause IB.19.

16.2 In exceptional circumstances prior to expiry of original bid validity period, the Employer may request the bidders to extend the period of validity for a specified additional period which shall in no case be more than the original bid validity period. The request and the responses thereto shall be made in writing. A bidder may refuse the request without forfeiture of his Bid Security. A bidder agreeing to the request will be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.15 in all respects in which case, the Employer will be obligated to compensate the bidders, upon substantiation for their increase in costs (if it is a fixed price bid).

IB.17 Format and Signing of Bid

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

17.2 All schedules and appendices to Bid are to be properly completed and signed.

17.3 No alteration is to be made in the Letters of Price and Technical Bids nor in the Appendices thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the bid may be rejected.

17.4 The Bidder shall prepare one original of the Technical Bid and one original of the Price Bid comprising the Bid as and clearly mark it "ORIGINAL - TECHNICAL BID" and "ORIGINAL - PRICE BID". In addition, the Bidder shall submit two (2) copies of the Bid and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

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

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

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

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

D. SUBMISSION OF BIDS

IB.18 Sealing and Marking of Bids

18.1 Each bidder shall submit his bid as under:

(a) ORIGINAL and each COPY of the Bid shall be <u>separately sealed</u> and put in separate envelopes and marked as such.

(b) The envelopes containing the ORIGINAL and COPIES will be put in one sealed envelope and addressed / identified as given in Sub- Clause 18.2 hereof.

(c) The technical bid should comprise of documents listed in IB.9 (A) & the price bid should comprise of documents listed in IB.9 (B) which shall be placed in separate envelopes in accordance with IB.9.

18.2 The inner and outer envelopes shall;

(a) be addressed to the Employer at the address given in Sub-Clause 6.1 heretofore.
(b) bear the Project name, identification No. and Date of opening of Bid.
(c) provide a warning not to open before the time and date for bid opening.

18.3 The Bid shall be delivered in person or sent by registered mail at the address to Employer as given in Sub-Clause 6.1 heretofore.

18.4 In addition to the identification required in Sub-Clause 18.2 hereof, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause IB.20.

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

IB.19 Deadline for Submission of Bids

19.1 (a) Bids must be received by the Employer at the address specified in Sub-Clause 6.1 hereof not later than the time and date stipulated in the Invitation for Bids.

(b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of bids.

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

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

19.2 Bids submitted through telegraph, telex, fax or e-mail shall <u>not</u> be considered.

19.3 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an addendum in accordance with Clause IB.7, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.20 Late Bids

20.1 (a) Any bid received by the Employer after the deadline for submission of bids prescribed in Clause IB.19 will be <u>returned unopened</u> to such bidder.

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

IB.21 Modification, Substitution and Withdrawal of Bids

21.1 Any bidder may modify, substitute or withdraw his bid after bid submission provided that modification, substitution or written notice of the withdrawal is received by the Employer prior to the deadline for submission of bids.

21.2 The modification, substitution or notice for withdrawal of any bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.18 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL", as appropriate.

21.3 No bid may be modified by a bidder after the deadline for submission of bids except in accordance with IB 21.1 and IB.46

21.4 Withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in forfeiture of the Bid Security pursuant to Clause IB.15.

E. BID OPENING AND EVALUATION

IB.22 Bid Opening

22.1 A committee consisting of nominated members by the Employer and by the Engineer will open the bids, including withdrawals, substitution and modifications made pursuant to Clause IB.21, in the presence of bidders' representatives who choose to attend, at the time, date and location stipulated in the Invitation for Bids.
The bidders' representatives who are present shall sign in a register evidencing their attendance.

22.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first and the name of the Bidder shall be read out. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.21 shall not be opened.

22.3 The bidder's name, Bid Prices, unit rates, any discount and price of any Alternate Proposal(s), bid modifications, substitutions and withdrawals, the presence or absence of Bid Security, and such other details as the Employer at its discretion may consider appropriate, will be announced by the Employer at the bid opening. The Employer will record minutes of bid opening.

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.

22.4 Discounts offered for lesser period than the bid validity shall not be considered in evaluation.

IB.23 Clarification of Bids

23.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any bidder for clarification of his bid, including breakdowns of unit

rates. The request for clarification and the response shall be in writing but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause IB.26.

23.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer‟s request for clarification, its bid may be rejected.

IB.24 Examination of Bids & Determination of Responsiveness

24.1 Prior to the detailed evaluation of bids, the Employer will determine whether each bid is substantially responsive to the requirements of the Bidding Documents.

A substantially responsive bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required Bid Security; (iv) Includes signed Integrity Pact where required as per clause IB.43 and (v) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation. A material deviation or reservation is one (i) which affect in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the Bidding Documents, the Employer‟s rights or the bidder‟s obligations under the Contract; (iii) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids. Only substantially responsive bid shall be considered for further evaluation.

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

24.2 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 Employer/Engineer 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.

IB.25 Conversion to Single Currency

25.1 **(NOT APPLICABLE)**

IB.26 Evaluation and Comparison of Bids

26.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.24.

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

(a) Making any correction for errors pursuant to Clause IB.46,

(b) Excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Day work; and

(c) Making an appropriate adjustment for any other acceptable variation or deviation.

(d) A domestic preference will be given to domestic or national contractor, as per rules, on the total bid price, for bid evaluation and comparison only.

26.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

26.4 If the Bid of the successful bidder is seriously unbalanced in relation to the Employer"s estimate of the cost of work to be performed under the Contract, the Employer may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the Performance Security set forth in Clause IB.34 be increased at the expense of the successful bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful bidder under the Contract.

IB.27. Domestic Preference

A domestic preference will be given to domestic or national contractor, as per rules, on the total bid price, for bid evaluation and comparison only.

IB.28 Process to be Confidential

28. 1 Subject to Clause 23 heretofore, no Bidder shall contact Employer and/or Engineer 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 Employer. The evaluation result shall be announced at least ten (10) days prior to award of Contract. The announcement to all bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated.

28.2 Any effort by a Bidder to influence Employer and/or Engineer 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 not later than fifteen (15) days after the announcement of the bid evaluation result; however, mere

fact of lodging a complaint shall not warrant suspension of the procurement process.

F. AWARD OF CONTRACT

IB.29. Post-Qualification

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

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

29.2 The determination will take into account the bidder's financial, technical and production capabilities. It will be based upon an examination of the documentary evidence of the bidder's qualification submitted under Appendix B to Instructions to Bidders "Evidence of Bidder's Capability" by the bidder pursuant to Clause IB.13, as well as such other information as required under the Bidding Documents.

29.3 An affirmative determination will be a pre-requisite for award of the Contract to the lowest evaluated bidder. A negative determination will result in rejection of that bidder's bid in which event, Employer will proceed to undertake a similar determination of the next lowest evaluated bidder's capabilities to perform the Contract satisfactorily.

IB.30 Award Criteria

30.1 Subject to Clause IB.32, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price, provided that such bidder has been determined to be qualified to satisfactorily perform the Contract in accordance with the provisions of Clause IB.29.

IB.31 Employer's Right to Vary Quantities

31.1 Employer reserves the right at the time of award of Contract to increase or decrease by upto 15% the quantity of goods and services specified in the Schedule of Prices without any change in the unit price or other terms and conditions.

IB.32 Employer's Right to Accept any Bid and to Reject any or all Bids

32.1 Notwithstanding Clause IB.30, the Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidders or any obligation except that the grounds for rejection of all bids shall upon request be communicated to any bidder who submitted a bid, without justification of grounds. Rejection of all bids shall be notified to all bidders promptly.

IB.33 Notification of Award

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

33.2 The Letter of Acceptance and its acceptance by the bidder will constitute the formation of the Contract, binding the Employer and the Bidder till signing of the formal Contract Agreement.

33.3 Upon furnishing by the successful bidder of a Performance Security, the Employer will promptly notify the other bidders that their bids have been unsuccessful and return their bid securities.

IB.34 Performance Security

34.1 The successful bidder shall furnish to the Employer 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.

34.2 Failure of the successful bidder to comply with the requirements of Sub-Clause IB.34.1 or Clause IB.35 or Clause IB.43 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

IB.35 Signing of Contract Agreement

35.1 Within fourteen (14) days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will send to the successful bidder the Form of Contract Agreement provided in the Bidding Documents, duly filled in and incorporating all agreements between the parties for signing and return it to the Employer.

35.2 The formal Agreement between the Employer and the successful bidder shall be executed within fourteen (14) days of the receipt of such Form of Contract Agreement by the successful bidder from the Employer.

G. ADDITIONAL INSTRUCTIONS

IB.36 Instructions not Part of Contract

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

IB.37 Contract Documents

37.1 The Documents which will be included in the Contract are listed in the Form of Contract Agreement set out in these Bidding Documents.

The Contractor must provide Six (06) copies of "The Contract Documents" to the Employer/Client.

IB.38 Sufficiency of Bid

38.1 Each bidder shall satisfy himself before Bidding as to the correctness and sufficiency of his Bid and of the rates and prices entered in the Schedule of Prices. Except insofar as it is otherwise expressly provided in the Contract, the rates and prices entered in the Schedule of Prices shall cover all his obligations under the Contract and all matters and things necessary for the proper completion of the Works.

IB.39 One Bid per Bidder

39.1 Each bidder shall submit only one bid either by himself, or as a partner in a joint venture. A bidder who submits or participates in more than one bid (other than alternatives pursuant to Clause IB.41) will be disqualified and bids submitted by him shall not be considered for evaluation and award.

IB.40 Bidder to Inform Himself

40.1 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. This shall include but not be limited to the following:

(a) inquiries on Pakistani Income Tax/Sales Tax to the Commissioner of the Income Tax and Sales Tax, **Punjab Revenue Authority**, Pakistan.

(b) inquiries on customs duties and other import taxes, to the concerned authorities of Customs and Excise Department.

(c) information regarding port clearance facilities, loading and unloading facilities, storage facilities, transportation facilities and congestion at Pakistan seaports.

(d) investigations regarding transport conditions and the probable conditions which will exist at the time the Goods will be actually transported.

IB.41 Alternate Proposals by Bidder

41.1 Should any bidder consider that he can offer any advantage to the Employer by a modification to the designs, specifications or other conditions, he may, in addition to his bid to be submitted in strict compliance with the Bidding Documents, submit any Alternate Proposal(s) containing (a) relevant design calculations; (b) technical specifications; (c) proposed construction methodology; and (d) any other relevant details / conditions, provided always that the total sum entered on the Form of Bid shall be that which represents complete compliance with the Bidding Documents.

41.2 Alternate Proposal(s), if any, of the lowest evaluated responsive bidder only may be considered by the Employer as the basis for the award of Contract to such bidder.

IB.42 Local Conditions

42.1 Bidder must verify and supplement by his own investigations the information about site and local conditions. However, Employer will assist the Bidder wherever practicable and possible.

IB.43 Integrity Pact

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

IB.44 Site Visit

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

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

IB.45 Pre-Bid Meeting

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

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

Minutes of the pre-bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively either through the issue of an Addendum pursuant or through the minutes of the pre-bid meeting.

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

IB.46 Correction of Errors

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

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

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

The amount stated in the Letter of Price Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid Security shall be forfeited.

IB.47 General Performance of the bidders

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

Appendix A to
Instructions to Bidders

NAME OF ELIGIBLE COUNTRIES

All manufacturers of the world except Israel, who has valid type tested report of their equipments which is in compliance with the NTDC relevant specifications and type test policies.

Appendix B to
Instructions to Bidders

EVIDENCE OF BIDDER'S CAPABILITY

[Note: Bidders to provide the following information with the bid separately and indicate herein its references where this information is available.]

Sr.No.	Information to be Supplied	Bid References
1.	Name of bidder, business address and country of incorporation.	
2.	Type of firm whether individually owned, partnership, corporation or joint venture and the names of its owners or partners.	
3.	The annual reports or qualification statements giving general description of the firm, sort of business carried out, balance sheets, profit and loss statements, turn over and business done by the firm, duly authenticated, for the last three (3) years. Audited Balance Sheets for the preceding 3 years and projected assets and liabilities for the next 2 years shall be provided.	
4.	Location and address of manufacturing facilities.	
5.	Full description of factories owned and the annual manufacturing capacities of various items made therein.	
6.	Details of the factory or factories where the offered equipment is proposed to be manufactured. This description should include the facilities and capacities of the particular factories including testing facilities and the processes used in manufacturing and testing. Where parts or components are purchased from outside, the details of equipment purchased and the names and experience record of the suppliers.	

Sr.No.	Information to be Supplied	Bid References
7.	Detailed description of the quality control testing and research facilities. If the equipment is manufactured under license, the name of the licenser and details of the licensing arrangements, such as the duration of the license, the facilities provided to the bidder by the licenser and whether future improvements are available or not etc. A copy of the license agreement may be attached.	
8.	Names, qualifications and experience of the key technical personnel as per clause IB 13.4(c). Attach CV's of the listed personnels.	
9.	The time since the manufacturer has been in this business and the time since he has been doing work of similar nature.	
10.	The list of equipment which contractor must have or access to as per subclause 13.4(d)	
11.	Reference lists of similar works done by the bidder in its country and abroad indicating the name of customer, description and quantity of product, year of supply and the approximate value, as per subclause IB 13.4(a)	
12.	Proof of Financial capability as per subclause IB 13.4(a) & IB 13.4(b)	
13.	Details of projects under execution and future contractual commitments (for each partner, in case of a joint venture).	
14.	Banking reference, names of banks and addresses may be given to whom reference regarding financial capability of the bidder may be made, with authority to make inquiries from the bidder's bankers and clients regarding any financial and technical aspects (for each partner, in case of a joint venture).	

Sr.No.	Information to be Supplied	Bid References
15.	Information on any litigation or arbitration resulting from contracts completed or under execution by the bidder over the last ten (10) years. The information shall indicate the parties concerned, the matter of dispute, the disputed amounts and the result thereof (for each partner, in case of a joint venture).	

FORM OF BID AND SCHEDULES TO BID

Letter of Price Bid

Date: .....
Bid Reference No:…….
(Name of Contract/Works)
To:……

We, the undersigned, declare that:

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

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

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

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

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

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

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

(h) We agree to permit Employer or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors. This permission is extended for verification of any information provided in our Technical Bid which comprises all documents enclosed herewith in accordance with IB.11.1 of the Bidding Documents.

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

Name .....
In the capacity of .....
Signed .....
Duly authorized to sign the Bid for and on behalf of .....
Date .....
Address……..

SCHEDULES TO BID INCLUDE THE FOLLOWING:

- Schedule A to Bid: Specific Works Data
- Schedule B to Bid: Work to be Performed by Subcontractors
- Schedule C to Bid: Proposed Programme of Works
- Schedule D to Bid: Deviations from Technical Provisions
- Schedule E to Bid: Deviations from Contractual Conditions
- Schedule F to Bid: Method of Performing Works
- Schedule G to Bid: Proposed Organisation
- Schedule H to Bid: Integrity Pact
- Schedule I to Bid: List of Major Equipment
- Schedule J to Bid: Camp Office of Contractor
- Schedule K to Bid: List of Subcontractors

SCHEDULE – A TO BID

SPECIFIC WORKS DATA

The schedule of Technical Data for each equipment is given in respective specifications contained in Volume-II of these bidding documens. However, the Bidder must supplement the main technical data by providing hereunder other salient parameters including main equipment make, capacity and suitability for the works under consideration to enable the Employer/"The Engineer" to assess technical conformance of the proposed process and the means available with the contractor to do it.

SCHEDULE – B TO BID

WORK 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 Work to be Sub-Contracted	Name and address of Sub-Contractor	Statement of similar works previously executed (attach evidence)

Note:

1. No change of Sub-Contractor shall be made by the bidder without prior approval of the Employer.
2. The truthfulness and accuracy of the statement as to the experience of Sub-Contractors is guaranteed by the bidder. The Employer'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 work, year completed and name & address of the clients.

SCHEDULE – C TO BID

PROPOSED PROGRAMME OF WORKS

Bidder shall provide a programme in a bar-chart/CPM/PERT form showing the sequence of work items by which he proposes to complete the work 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.

	Description	**Time for Completion**
a)	Whole Works	_____ days
b)	Part-A	_____ days
c)	Part-B	_____ days
d)	_____	_____ days
e)	_____	_____ days

SCHEDULE – D TO BID

DEVIATIONS
FROM
TECHNICAL PROVISIONS

It is presumed that the bidder shall not take any deviation. However, if he intends to take deviations to the specified terms, those must be listed in the space provided below:

Sr. No.	Clause No. / Section No.	Deviations/Clarifications

[Note**:** Attach additional sheets, if necessary]

SCHEDULE – E TO BID

DEVIATIONS
FROM
CONTRACTUAL CONDITIONS

It is presumed that the bidder shall not take any deviation. However, if he intends to take deviations to the specified Contractual/Commercial Conditions, those must be listed in the space provided below:

Sr. No.	Clause No. / Section No.	Deviations/Clarifications

[Note: Attach additional sheets, if necessary]

SCHEDULE – F 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 constructional and erection plant, tools and vehicles proposed to be used in carrying out the Works at Site, including number of each kind, make, type, capacity of all equipment, working condition, which shall be deployed by him for Civil Work and Erection, Testing and Commissioning of the Works, in sufficient detail to demonstrate fully that the equipment will meet all the requirements of the Technical Provisions.

- The procedure for installation of equipment and transportation of equipment and materials to the site.

- Details regarding mobilisation in Pakistan, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for storage, communications, security and other services to be used.

- Organisation chart indicating head office & field office personnel involved in management, supervision and engineering of the Works to be done under the Contract.

SCHEDULE – G TO BID

PROPOSED ORGANISATION

The bidder shall list in this Schedule the key personnel he will employ from Head office and from Site office to direct and execute the Works, together with their names, qualifications, experience, positions held and their nationalities.

Designation	Name of	Summary of Qualifications Experience, Present Position and Nationality

- Head Office:

- Site Office:
  Contractor's Representative
  Site Superintendent
  Supervising Engineer
  Plant Erectors
  Construction Supervisors
  Other Key Staff

SCHEDULE – H TO BID

(INTEGRITY PACT)

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

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

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

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

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

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

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

Name of Buyer: ……	Name of Seller/Supplier: ……
Signature: ……	Signature: ……
[Seal]	[Seal]

SCHEDULE – I TO BID

LIST OF MAJOR EQUIPMENT – RELATED ITEMS

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

LIST OF MAJOR EQUIPMENT

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

Equipment:

The Bidder must demonstrate that it has the key equipment listed hereafter:

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

SCHEDULE – J TO BID

CAMP OFFICE OF CONTRACTOR

The Contractor shall provide description of his Camp Office facilities.

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

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

1. Site Preparation (clearing, land preparation, etc.).

2. Provision of Services.

a) Power (expected power load, etc.).
b) Water (required amount and system proposed).
c) Sanitation (sewage disposal system, etc.).

3. Construction of Facilities

a) Type of construction of Camp Office.
b) Warehouses and Storage Areas (area required, type of construction and layout).

4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).

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

6. Detail of testing Lab with testing equipment etc.

SCHEDULE – K TO BID

LIST OF SUBCONTRACTORS

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

Enclosed are documentation outlining experience of subcontractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past.

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

SCHEDULE OF PRICES

	Description
1.	Preamble to Schedule of Prices
2.	Schedule of Prices
	2. (a) Equipment, Erection, Testing & Commissioning
	2. (b) Civil Works

1. PREAMBLE TO SCHEDULE OF PRICES

1. General

1.1 The Schedule of Prices shall be read in conjunction with the Conditions of Contract together with the Specifications and Drawings.

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 Work.

2. Description

2.1 The general directions and descriptions of work 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.

2.2 The quantities shown in the Schedule of Prices are estimated quantities only as an indication of the Scope of Work to enable the bidder to bid for different items of the Works for his estimate of costs. The estimated quantities shall be used for comparing the bids. It is, however, to be noted that in the event of any increase or decrease in the quantity of any item of Works and subject to provisions of the Conditions of Contract herein, the actual quantities executed will be paid.

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).

The following abbreviations shall be used in the Schedule of Prices:

	Abbreviation
Foreign Currency Component	FCC
Local Currency Component	LCC
United States Dollars	US$
Pakistani Rupees	PKR/Rs
Number	No.
Kilometer	km
Kilogram	Kg
Cubic Meter	Cu.m
Provisional Sum	PS
Percent	%

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 work

set forth or implied in the Contract; except for the amounts reimbursable to the Contractor under the Contract.

4.2 Unless otherwise stipulated in the Conditions of Contract, the rates and prices entered by the bidder shall not be subject to adjustment during the performance of the Contract.

4.3 All duties, taxes, GST and other levies payable by the Contractor under the Contract, or for any other cause, as on the date twenty eight (28) days prior to the deadline for submission of bids shall be included in the rates and prices and the total Bid Price submitted by a bidder, ***(except Punjab Sales Tax).***

Additional/reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed/deducted as per provisions of the Conditions of Contract.

4.4 The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced 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 Employer when executed and shall be deemed covered by the rates and prices for other items in the Schedule of Prices.

4.5 The bidder shall be deemed to have obtained all information as to port clearance facilities and charges, loading and unloading facilities and charges, storage facilities and charges, transportation facilities and charges, congestion and/or other conditions to be expected at Karachi Port and or any other seaport of Pakistan and all requirements related thereto.

The Contractor shall be responsible to make complete arrangements for the transportation of the Plant to the Site.

The bidder shall be deemed to have included all clearing, forwarding and other incidental costs in this regard in his bid. The Contractor will have the option to use either Karachi Port or or any other seaport of Pakistan.

4.6 The Contractor shall provide for all parts of the Works to be completed in every respect for commercial operation. Notwithstanding that any details, accessories, etc. required for the complete installation and satisfactory operation of the Plant, are not specifically mentioned in the Specifications, such details shall be considered as included in the Contract Price.

5. Bid Prices

The total of bid prices under local currency column in the Schedule of Prices shall be

entered in the Summary of Bid Prices. The unit rates and prices and lumpsum amount entered in the Schedule of Prices will be the rates at which the Contractor will be paid, and shall be deemed to be the full inclusive value of the work including all costs of performing the Works such as overheads, income tax, GST, any other applicable tax according to law, super tax, profits, costs of accepting the general risks, liabilities and obligations set forth or implied in the Contract, ***except Punjab Sales Tax*** and except for the amounts reimbursable, if any, to the Contractor under the Contract. The rates shall also include Contractor's cost for providing Performance Security and other Bank Guarantees required for performance of the Contract.

DAYWORK SCHEDULE

1. General

1.1 Work shall not be executed on a Daywork basis except by written Order of the Engineer. The rates for Daywork items entered in the Schedule of Prices shall apply to any quantity of Daywork ordered by the Engineer. Nominal quantities have been indicated against each item of Daywork, and the extended total for Daywork shall be carried forward as a provisional sum to the Summary of Bid Prices.

2. Daywork - Labour

2.1 In calculating payments due to the Contractor for the execution of Daywork, the hours for labour shall be reckoned from the time of arrival of the labour at the job Site to execute the particular item of Daywork to the time of departure, but excluding meal breaks and rest periods. Only the times of classes of labour directly doing work ordered by the Engineer and for which they are competent to perform shall be measured.

The time of Plant Erectors or other expatriate supervisory personnel shall not be measured unless their time on Site is extended by Variation Order. The rates entered by the Bidder for these categories shall be daily rates inclusive of all allowances and overheads.

2.2 For labour other than Plant Erectors or other expatriate supervisory personnel, the Contractor shall be entitled to payment in respect of the total time that labour is employed on Daywork, calculated at the basic rates entered by him in the Schedule of "Daywork Rates – Labour" together with an additional percentage payments on basic rates representing the Contractor's profit, overheads, etc., as described below:

a) The basic rates for labour shall cover all direct costs to the Contractor, including (but not limited to) the amount of wages paid to such labour, transportation time, overtime, subsistence allowances and any sums paid to or on behalf of such labour for social benefits in accordance with Pakistan Labour laws. The basic rates will be payable in Pak. Rupees only, and

b) The additional percentage payment to be quoted by the Bidder and applied to costs shall be deemed to cover the Contractor's overheads, profits, superintendence, liabilities and insurances and allowances to labour, timekeeping and clerical and office work, the use of consumable stores, water, lighting and power; the use and repair of staging, scaffolding, workshops and stores, portable power tools, manual plant and tools; supervision by the Contractor's staff, foremen and other supervisory personnel; and charges incidental to the foregoing. Payments under this item shall be made in foreign currency and local currency at the percentages entered in the Daywork Schedule.

2.3 Rates entered in the Daywork Schedule shall apply to labour of trade and

qualification as described and to labour of other trades with similar skill and qualification.

3. Daywork - Contractor's Equipment

3.1 The Contractor shall be entitled to payments in respect of Contractor's Equipment already on Site and employed on Daywork at the basic rental rates entered by him in the "Schedule of Daywork Rate - Contractor's Equipment". The said rates shall be deemed to include complete allowance. for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricants and other consumables and all overheads, profit and administrative costs related to the use of such equipment.

3.2 In calculating the payment due to the Contractor for Contractor's Equipment employed on Daywork, only the actual number of working hours will be eligible for payment, except that, where applicable and agreed with the Engineer, the travelling time from the part of the Site where the Contractor's Equipment was located when ordered by the Engineer to be employed on Daywork and the time for the return journey thereto shall be included for payment.

3.3 The rental rates for Contractor's Equipment employed on Daywork shall be stated in Pakistani Rupees but payments to the Contractor will be made in local and foreign currencies according to the rates entered in the Schedule.

4. Daywork-Materials

4.1 The Contractor shall be entitled to the following payments in respect of materials used for Daywork (except for materials for which the cost is included in the percentage addition to labour costs) which are actually incorporated into the Works:

a) The net cost of such materials delivered to warehouse or workyard area or storage area at the Site. Such cost shall be calculated by the Contractor on the basis of the invoiced price and freight and insurance as certified by the Engineer on the basis of invoices produced.

b) Percentage addition, in local and/or foreign currency, of such net cost of materials to cover the Contractor's handling charges, overheads and profits.

4.2 Payment of the net cost to the Contractor of Daywork materials shall be made in the same currency as the invoice. Payment of the addition for handling charges, overheads and profit shall be in local and/or foreign currency as entered in the Schedule of Daywork - Materials.

Schedule of Prices

2. (a) SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.

BILL OF QUANTATIES
SUMMARY

A	**SCHEDULE ITEMS:-**			
1	11kV Equipment with Allied Works	Rs.	9,187,243	
2	Panel Room Internal Electrification	Rs.	1,320,704	
3	Panel Room Civil Works	Rs.	6,270,839	
4	3-Way RMU Foundation	Rs.	314,349	
	Sub Total "A"	Rs.	17,093,135	
	NON-SCHEDULE			
B	**ITEMS:-**			
1	11kV Equipment with Allied Works	Rs.		
2	Panel Room Internal Electrification	Rs.		
3	Panel Room Civil Works	Rs.		
4	3-Way RMU Foundation	Rs.	Nil	
	Sub Total "B"	Rs.		
	Total "A+B"	Rs.		

BID PRICE

C	Schedule Items Rs 17,093,135 x _____% Above / Below	Rs.	
D	Total (A+B+C)	Rs.	
E	5% PRA Tax on D	Rs.	
F	**Grand Total Inclusive All Taxes (D+E)**	**Rs.**	

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.						
SCHEDULE ITEMS						
A1 - 11KV EQUIPMENTS WITH ALLIED WORKS.						
Sr. No.	**MRS 1st 2025**	**Description**	**Unit**	**Qty.**	**Rate**	**Amount (Rs.)**
1	24/16	Supply, installation, testing, commissioning and termination of 8.7 / 15kV, AL/XLPE/UA/PVC three Core (MV cables) of Pakistan cables / Newage or approved equivalent along with cable glands, in already installed cable trench / cable ladder / cable tray / duct bank.				
	b	Armoured Cable				
	iv	120 mm sq	Mtr.	300	9,610	2,882,955
2	24/14	Supply and erection of PVC insulated, PVC sheathed copper conductor ditto cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only):				
	d	Four Core, 600/1000 volt armoured cable:				
	viii	240 mm sq (37/0.114)	Mtr.	40	43,924.35	1,756,974
3		P/F floor mounted Electric Panel board of required depth and size, fabricarted with 14SWG M.S sheet (Indoor/Outdoor Type),derusting, zinc Phosphated, finish with electro static powder coating in approved colour i/c the cost of capacitor trip unit over current, Lock, Indication lights, Brass glands, Netural & Earth bar, Digital volt meter/ Amp meter, Slector switchs, Current Transformers, Controles, Channels, Copper bus bars of specified capacity ,Door Earthing, complete in all respects as approved and directed by the Engineer Incharge (Breakers will be Paid Separately).				
		1. LT Switchboards				
		2.50 Ft deep				
		250~600A	Cft	180	4,343.85	781,893

4	24/91	P/F ACB (Air Circuit Breaker) of specified rating made of LEGRAND FRANCE/ GE U.S.A / SCHNEIDER GERMANY / TERASAKI JAPAN/ABB SWITZERLAND or approved equivalent manufacturer in prelaid Panels i/c the cost of screws,necessary wire complete in all respect as approved and directed by the Engineer Incharge.				
	a	Triple Pole (65 KA)				
	ii	1000-1250 Amp	No.	6	627,570.20	3,765,421
TOTAL						**9,187,243**

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.						
SCHEDULE ITEMS:-						
A2-Panel Room Internal Electrification						
Item No.	**MRS 1st 2025**	**Description**	**Unit**	**Qty**	**Unit Rate (Rs)**	**Amount (Rs)**
A1. Schedule Items						
1	24/13	Supply and erection of copper conductor cables for service ditto connection, in prelaid pipe/G.I. wire/ trenches, etc. (rate for cable only):-				
	c	PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable:-				
a	vii	10.00 mm sq (7/0.052")	Mtr	200	505.50	101,100
2	24/90	Supplying, Installation and commissioning of MCCB (Moulded Case Circuit Breaker) of specified rating made of LEGRAND-FRANCE / GE-U.S.A / SCHNEIDER-GERMANY / TERASAKI-JAPAN / ABB-SWITZERL or approved equivalent manufacturer (with adjustable Thermal-Magnetic Trip) in prelaid DBs and Panels i/c the cost of screws, necessary wire complete in all respect as approved and directed by the Engineer Incharge.				
	a	Triple Pole With Adjustable Thermal-Magnetic Trip /Electronic Trip (60-100%)				
a	i	25-100 Amp(25 KA) 63 I/C & 1 No 63	No.	8	19,859.40	158,875
3	24/93	P/F wall mounted DB (DistributionBoard made with 16SWG Sheet (Recessded/ Surface mounted Type), Powder coated Paint, i/c the cost of Lock, Indication lights, Thimble, Copper Comb, Wiring, Netural & EarthBar, Door Earthing, Digital Voltmeter, Digital Ammeter, Volt Selector Switch, Ammeter selector switch, Current Transformers and Controles Complete in all respect as approved and directed by the Engineer Incharge (Breakers will be Paid Separately).				

	a	6" deep				
a	i	20~60A	cft.	8	24,422.65	195,381
4	24/88	Suppling,Installation and comissioning of MCB (Miniature Circuit Breaker) of specified rating made of LEGRAND FRANCE/ GE U.S.A / SCHNEIDER GERMANY /SIEMEN GERMAN/TERASAKI JAPAN/ ABB SWITZERLAND in prelaid DBs and Panels i/c the cost of screwes, necessary wire complete in all respect as approved and directed by the Engineer Incharge.				
	a	Single Pole				
a	ii	6-40 Amp (6 KA) 10 O/G GF	No.	24	1,127.50	27,060
b	ii	6-40 Amp (6 KA) 20 O/G MF	No.	24	1,127.50	27,060
5	24/3	Supply and erection of PVC pipe for wiring recessed in walls, including inspection boxes, pull boxes, hooks, cutting jharries and repairing surface, etc., complete with all specials.				
a	iii	25 mm i/d	Mtr	160	438.20	70,112
6	24/6	Supply and erection PVC pipe for recessed wiring (main and sub-main) purpose, including bends, specials, etc. in floor, wall or trenches:-				
a	iii	100 mm i/d	Mtr	40	1,242.25	49,690
7	24/11	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I pipe/wooden strip batten/wooden casing an capping/G.I. wire/trenches (rate for cables only):-				
	a	250/440 volts, PVC insulated:				
a	ii	3/0.91 mm (3/0.036"), For Light, Fan or Light to Light Points	Mtr	180	118.40	21,312
b	iii	7/0.74 mm (7/0.029"), For Circuit, Power and Sockets Wiring	Mtr	180	184.70	33,246

8	24/105	Providing and fixing Copper winded Exhaust fan with louver and shutter made of Pak/Younas/G.F.C. i/c the cost of necessary cable and hardware for connection from ceiling rose complete as aoproved and directed by Engineer Incharge				
	b	Steel body				
a	i	12" dia	Each	12	5,866.45	70,397
9	24/107	Providingand fixing Pakistan Energy Label NEECA approvedCopper winded Ceiling Fan i/c the cost of necessary cable and hardware for connection as approved and directed by Engineer Incharge.				
a	i	36" dia	Each	12	8,949.40	107,393
10	24/108	P/F PVC double layer Switch kit Face plate with specified switch holes i/c the cost of switches / sockets / dimmer made of Hi-Life/ Bush / Schenider, screws complete as approved and directed by the Engineer Incharge				
		Small				
a	iv	Three pin Light Plug 10/13 Amp	Each	24	741.25	17,790
b	viii	Three Pin Power Plug 15-32 Amp	Each	24	911.35	21,872
		Large				
c	i	04 Gange	Each	8	968.05	7,744
d	iii	06 Gange	Each	12	1,392.65	16,712
11	24/110	P/F PVC concealed Switch kit Box i/c the cost of screws complete as approved and directed by the Engineer Incharge				
a	i	Small	Each	48	179.30	8,606
b	ii	Large	Each	20	208.25	4,165
12	24/177	Supply, Installation, Testing & Commissioning of complete grounding system:				
a	iii	10 mm² CU bare conductor	Rft			

				160	478.60	76,576
13	3/46	Excavation of trenches in all kinds of soil, except cutting rock, for watersupply pipelines upto 5 ft. (1.5 m) depth from ground level, including trimming, dressing sides, leveling the beds of trenches to correct grade and cutting pits for joints, etc. complete in all respects	Cum.	90	398.90	35,901
14	10/3	Supply and filling sand under floor or plugging in wells	Cum.	30	1,450.60	43,518
15	7/23	Dry Brick Pitching	Cum.	22	10,064.10	221,410
16	3/13	Rehandling of Earth work: a) Lead upto a single throw of kassi, phaorah or shovel	Cum.	36	132.85	4,783
TOTAL (A) Rs.						**1,320,704**

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.

SCHEDULE ITEMS:-

A3- PANEL ROOM CIVIL WORKS

Sr. Nos.	MRS1st Bi-Annual 2025 (Chap/Item)	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
1		Earthowrk in ordinary soil for embankments lead upto 100 ft. (30 m), including ploughing and mixing with blade grade or disc harrow or other suitable equipment, and compaction by mechanical means at optimum moisture content and dressing to designed section, complete in all respects:-				
	ch.3/item # 5(i)+17(a+b+c) upto 5Km	i) 95% to 100% maximum modified AASHO dry density.	Cft.	5,446.36	20.43	111,269
2		Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) depth upto 5 ft (1.5m). 1) By Manual			-	-
	ch.3/item # 21	ii) in ordinary soil.	Cft	3,210.10	15.82	50,784
3	ch.26/item # 44	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concenterate (SC), Mixing Ability-HEXTAR with Ratio (1:250) = 540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10-years complete in all respect .as approved by the Engineer Incharge.	Sft.	4,253.63	12.55	53,383

4	ch.3/item # 15	Filling, watering and ramming earth under floors:-.			-	-
	(i)	i) with surplus earth from foundation, etc.	Cft	1,486.88	7.54	11,211
5	ch.6/item # 5 (f) (i)	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate):				
		(f) Ratio 1: 2: 4 (under floor & Ramp)	Cft	113.12	497.23	56,249
		(i) Ratio 1: 4: 8	Cft	746.59	375.16	280,091
6	ch.7/item # 4 (i)	Pacca brick work in foundation and plinth in:-. i) Cement, sand mortar:-				
		Ratio 1:4	Cft	2,694.96	383.17	1,032,630
7	ch.6/item# 37	Providing and laying damp proof course of cement concrete 1:2: 4(using cement, sand and shingle), including bitumen coating :- (b) with 2 coats of bitumen:				
		ii) 2" thick (50 mm)	Sft	168.53	138.38	23,320
8	ch.6/item # 39	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:- (b) with 2 coats of bitumen:- i) Ratio 1: 4				
		a) ½" thick (13 mm)	Sft	398.00	78.46	31,227
9	ch.7/item # 5/ (i)	Pacca brick work in ground floor:- i)cement, sand mortar:-			-	-
		Ratio 1:5	Cft	2,295.34	380.00	872,228

10	ch.6/ item # 6/	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-				
10A		(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-				
		(3) Type C (nominal mix 1: 2: 4)	Cft	846.37	767.20	649,334
11	ch.6/item # 13	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):-				
		(ii) Deformed bars (Grade-60)	Kg	2,539.10	303.10	769,603
12	ch.11/item # 10	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height.				
		b) ½" (13 mm) thick(1:3)	Sft	1,280.81	52.67	67,460
13	ch.11/item # 9/(b)	Cement plaster 1:4 upto 20' (6.00 m) height:-				
		b) ½" (13 mm) thick	Sft	7,671.27	46.18	354,259

14	ch.10/item 23/(a)	1½"(40 mm) thick mosaic flooring, consisting of ½ "(13 mm) mosaic topping of one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over 1"(25 mm) thick floor of 1:2:4 cement concrete, including rubbing and polishing complete with finishing :- (a) using grey cement	Sft	675.50	186.57	126,027
14-a	ch.10/item 44/(a)	Providing and fixing marble strip of any shade for dividing the mosaic flooring into panels				
		a) Size 1½" x 3/8" (40 x 10 mm)	Rft	342.30	39.60	13,555
14-b	ch.10/item 37/(a)	Mosaic dado or skirting with one part of cement and marble powder in the ratio of 3:1 and two parts of marble chips, laid over ½"(13 mm) thick cement plaster 1:3, including rubbing and polishing, complete with finishing:(a) using grey cement:i) 3/8"(10 mm) thick	Sft	86.00	169.76	14,599
15	ch.13/item # 31 (a) (b)	Preparing surface and painting with emulsion paint:-				
		a) first coat	Sft	2,832.13	16.90	47,863
		b) 2nd and each subsequent coat	Sft	2,832.13	13.08	37,044
16	ch.13/item # 33	Providing and applying weather shield paint of approved quality on external surface of building including preparation of surface, application of primer complete in all respect: a) new surface:				
		i) 1st coat	Sft	4,216.85	47.26	199,288
		ii) 2nd coat	Sft	4,216.85	26.52	111,831

17	ch. 25/item # 31	Making and fixing steel grated door with 1/16" thick (1.5mm) sheeting, including angle iron frame 2"x2"x3/8" (50x50x10 mm) and ¾" (20 mm) square bars 4" (100 mm) centre to centre, with locking arrangement.	Sft	168.00	2,763.30	464,234
18	ch.25/item # 52	Providing and fitting all types of glazed aluminium windows of anodised/ powder coated partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 30 mm (4"x1-1/4") and leaf frame sections of 50 x 20 mm (2"x¾"), all of 1.6mm thickness including 5 mm thick imported tinted glass with rubber gasket using approved standard latches, hardware etc., as approved by the Engineer in-charge.	Sft	96.00	1,306.55	125,429
19	9/5	Single layer of tiles 9"x4½"x1½" (225x113x40 mm) laid over 4"(100 mm) earth and 1" (25 mm) mud plaster without Bhoosa, grouted with cement sand 1:3 on top of RCC roof slab, provided with 34 lbs. per %Sft. or 1.72 Kg/Sq.m bitumen coating sand blinded.	Sft	1,327.20	135.54	179,889
20	26/39 (a)	Supplying and laying polythene sheet over D.P.C. under floors and on roofs, etc. i) 300 gauge (.003" thick)	Sft	1,327.20	8.20	10,883
21	9/15	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	No.	4.00	1,196.30	4,785
22	ch. 25/item # 9	Small iron work, such as gusset plates, knees, bends, stirrups, straps, rings, etc. including cutting, drilling, riveting, handling, assembling and fixing; but excluding erection in position. (Grating, Ancor bolts etc.	Kg	603.79	491.95	297,035
23	ch. 25/item # 11	Erection and fitting in position iron trusses, staging of water tanks, etc.	Kg	603.79	18.62	11,243

24	ch. 23item # 26	Providing, laying, cutting, jointing, testing and disinfecting PVC/ uPVC pipe line with `B' Class working pressure pipe, in trenches, complete in all respects:-				
		b) 100 mm i/d	Rft	136.00	514.90	70,026
25	ch. 9/item # 16	Bottom Khuras of brick masonry in cement mortar 1:6,4'x2'x4½" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8	Each	4.00	2,274.05	9,096
26	ch.1/item No1	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl, kankar lime (unslaked), surkhi, etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor.(Sargodha Quarry)	Cft	1,410.81	131.10	184,964
Total Amount (A3)						**6,270,839**

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.						
Schedule Items						
A4 - 3-Way RMU Foundation						
Sr. No.	**MRS 1st BI-Annual 25**	**Description**	**Unit**	**Qty**	**Rate**	**Amount**
		Construction of foundation including all allied accessories for following Ring Main Unit (MV Switches), conforming to requirements, technical specifications, standards, Drawings etc. complete in all respect as per entire satisfaction of the Engineer. Contractor shall submit the detail foundation design for review before execution.(3-Way Type)				
1.0	3/21	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling around structure with excavated earth, watering and ramming lead upto one chain (30 m) and lift upto 5 ft. (1.5 m) a) By Manual ii) in ordinary soil.				
		3 Way RMU	Cum.	12.92		
		Total		**13.57**	558.90	7,583.33
2.0	6/5	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate): (i) Ratio 1: 4: 8				
		3 Way RMU	Cum.	0.29		
		Total		**0.30**	13,250.90	3,995.38

3.0	6/9	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-				
		(a) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:-3) Type C (nominal mix 1: 2: 4)				
		Total		**2.05**	27,097.50	55,543.16
4.0	6/13	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- ('c) Deformed bars (Grade-60)	Kg	217.19	303.10	65,830.82
5.0	7/7	Pacca brick work other than building upto 10ft. (3 m) height. i) cement, sand mortar:- Ratio 1:4				
		Total	**Cum.**	**12.69**	13,830.55	175,525.52
6.0	23/27	Providing, laying, cutting, jointing, testing and disinfecting PVC/ uPVC pipe line with `B' Class working pressure pipe, in trenches, complete in all respects:- e) 6" i/d (150mm)				
			m	**0.95**	6,212.25	5,870.58
Total						**314,349**

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.					
NON-SCHEDULE ITEMS:-					
B1 - 11KV EQUIPMENTS WITH ALLIED WORKS.					
Sr. No.	**Description**	**Unit**	**Qty.**	**Rate**	**Amount (Rs.)**
1	Supply, installation, testing and commissioning of 3-Way 11kV Ring Main Unit (MV Switches) complete (Pad-mounted) as per WAPDA Specification No. DD-S-46:2009 amended to-date on the already prepared foundations, according to drawings provided by the manufacturer including Earth fault indicators, cable termination boots for proper completion of each item as per specifications unless otherwise mentioned for proper completion. Drawings and Data should be submitted for the approval of PIEDMC Engineer before manufacturing and shipment.	Each	2		
2	Supply, installation, testing and commissioning of 11 KV industrial panels (For Metering)having CTs 100/5A, complete in all respects as per entire quality satisfaction of The Engineer. as per latest WAPDA/LESCO specifications P-44:2018. Drawings and Data should be submitted for the approval of PIEDMC Engineer before manufacturing and shipment.	Each	2		
3	Supply, installation, testing and commissioning of 11 KV industrial panels (For Protection) having CTs 100/5A, complete in all respects as per entire quality satisfaction of The Engineer. as per latest WAPDA/LESCO specifications P-44:2018. Drawings and Data should be submitted for the approval of PIEDMC Engineer before manufacturing and shipment.	Each	2		
4	Supply, installation, testing and commissioning of 11 KV Tranformer Protection panels having CTs 100/5A, complete in all respects as per entire quality satisfaction of The Engineer. Drawings and Data should be submitted for the approval of PIEDMC Engineer before manufacturing and shipment.	Each	4		
4	Supply ,installation, testing and commissioning of In door heat shrinkable Termination kits for H T 120 mm Sq. 1-c Al/XPLE/ PVC/armored Cable 15kV including bi-metallic lugs, cable glands and miscellaneous materials as per requirements, conforming to the latest Wapda/ IEC standards and specifications. Drawings/ data /specifications should be submitted for PIEDMC approval before manufacturing / shipment. Make: EU/UK/USA.	Each	20		

5	Supply ,installation, testing and commissioning of Out door heat shrinkable Termination kits for H T 120 mm Sq. 1-c Al/XPLE/ PVC/armored Cable 15kV including bi-metallic lugs, cable glands and miscellaneous materials as per requirements, conforming to the latest Wapda/ IEC standards and specifications. Drawings/ data /specifications should be submitted for PIEDMC approval before manufacturing / shipment. Make: EU/UK/USA.	Each	4		
6	Supply ,installation, testing and commissioning of In door heat shrinkable Termination kits for H T 500 mm Sq. 1-c Al/XPLE/ PVC/armored Cable 15kV including bi-metallic lugs, cable glands and miscellaneous materials as per requirements, conforming to the latest Wapda/ IEC standards and specifications. Drawings/ data /specifications should be submitted for PIE approval before manufacturing / shipment. Make: EU/UK/USA	Each	6		
7	Supply ,installation, testing and commissioning of MDI TOU Meter 0.2Class Accuracy including miscellaneous materials as per requirements, conforming to the latest Wapda standards and specifications. Drawings/ data /specifications should be submitted for PIE approval before manufacturing / shipment.	Each	6		
8	Supply ,installation, testing and commissioning of MDI TOU Meter 0.5Class Accuracy including cost of 600/5A Current Transformers(Make:PEL, Elmetec, Fico etc) 0.5 Class miscellaneous materials as per requirements, conforming to the latest Wapda standards and specifications. Drawings/ data /specifications should be submitted for PIE approval before manufacturing / shipment.	Each	12		
9	Supply, insatllation, commissioning and testing of oil cooled type, Step down Power Transformer pole mounted of specified rating,11/0.415 kV, i/c the cost of lifting hooks, thermometers, LT & HT bushing 5-steps, tap changer, imported double float buchholz relay, 2 earthing terminals, roller wheels, connecting terminals for cables M.S box on transformer in order to cover complete L.T side, all necessary materials required for connections on H.T & L.T side, rated voltage 11000/415/240 V specified impedance as specified by WAPDA/IEC system earth: Delta / Star, neutral solidly earthed complete in all respects made of PEL, Siemens, Transfopower, Elmetec or as approved and directed by the Engineer.**750kVA**	Each	4		
10	Supply, installation, testing & commissioning of Earthing System for 3-Way RMU, 11kV Industrial Panels, Transformer including ground conductor (10 mm stranded GI wire), clamp, M.S galvanized earth rods 5/8" x 13' and earth rod clamps etc.; to achieve the specified earthing results less than 5 Ohms as per requirements, specifications, Complete in all respect. and to the approval of the Consultant/The Engineer of PIE.	Each	32		
TOTAL					

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.					
NON-SCHEDULE ITEMS:-					
B2- Panel Room Internal Electrification					
Item No.	**Description**	**Unit**	**Qty**	**Unit Rate (Rs)**	**Amount (Rs)**
	LIGHTING FIXTURES				
1	Supply, installation, testing and commissioning of following fixtures complete in all respect including cost of all fixing accessories. All light fixtures shall be duly approved by Engineer before its purchase or installation. or Approved equivalent complete in all respect.				
	LED Fixtures light fittings ceiling or wall mounted or recessed in false ceiling, or Approved equivalent complete in all respect.				
a	Light Fixture Type LED Batten Ceiling/surface mounted, 40W complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	48		
b	Wall bracket Light Fixture Type LED 13 energy saving lamp Make: Philips with holder and complete in all respect with allied accessories. The fitting shall be approved by the Engineer.	Each	48		
c	50Watt LED Flood Light having IP65 rating, efficacy 85Lm/Watt, P.F>0.95 including cost of Clamps, Nuts bolts and accessories, for proper installation complete in all respect and to the approval of The Engineer	Each	24		
TOTAL (B) Rs.					

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 11KV ELECTRICAL EQUIPMENT WITH ALLIED CIVIL WORK FOR 11KV ELECTRICAL CONNECTION OF 2 NO'S STITCHING UNITS AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.						
NON-SCHEDULE ITEMS:-						
B3-Panel Room Civil Works						
Sr. Nos.	**MRS1st Bi-Annual 2025 (Chap/Item)**	**Description**	**Unit**	**Qty.**	**Rate (Rs.)**	**Amount (Rs.)**
1	NSI	Providing and fixing of steel grill for windows etc incl hold fast, 3 coats of synthetic enamel paint complete in all respects	Sft	96.00		
Total Amount (B3)						

PREAMBLE
TO
CONDITIONS OF CONTRACT

PREAMBLE TO CONDITIONS OF CONTRACT

Commencement Date	Sub-Clause 1.1.1.(i) The date for commencement of the Works is the date **of issuance of "The Engineer's" Written Order to Commence which shall be issued within 14 days of signing of Contract Agreement and also site possession has been delivered.**
Defect Liability Period	Sub-Clause 1.1.11 The Defect Liability Period is **365 days after the date certified in the Taking-Over Certificate but subject to extension for the damaged equipment within this period for further one year from the date of damage as provided under Sub-Clause 30.4.**
The Employer	Sub-Clause 1.1.12. The Employer is **Chief Executive Officer (CEO), Punjab Industrial Estates Development And Management Company (PIEDMC), Commercial Area (North), Sundar Industrial Estate, Sundar-Raiwind Road, Lahore**
The Engineer	Sub-Clause 1.1.15. The Engineer is **The Chief Engineer (Electrical)** **The Punjab Industrial Estates Development And Management Company (PIEDMC),** **or any competent person/firm/authority appointed by the Employer, and notified to the Contractor.**
Time for Completion	Sub-Clause 1.1.35. **The Time for Completion for whole of the Works is 60 days reckoned from the Commencement Date for the project. Separate date if different part/section of the projects are desired to be completed at different periods.**
Warranty Period	Sub-Clause 1.1.40. **The Warranty Period is Two (02) years after completion of Defect liability Period for (goods/equipment), Moreover, the Contractor shall provide respective warranty cards of manufacturer alongwith other documents (such as user manual etc) for each equipment.**
Engineer's Duties & Authorities	Sub-Clause 2.1 Amount of Variation Order is **15%**
Confirmation in Writing	Sub-Clause 2.6 (i) If the Contractor shall require the confirmation it shall be notified to the Engineer within **Ten (10)** days. (ii) Engineer shall confirm the decision/instruction within **Ten (10) days of the requirement.**
Ruling Language	Sub-Clause 5.1. The version in **English** language (ruling language) shall prevail.
Day to Day Communications	Sub-Clause 5.2. The language for day to day communications is **English**.
As-Built Drawings	Sub-Clause 6.10 As-Built drawings shall be provided to the Engineer within **Fifteen**

	(15) days from the date of issue of Taking Over Certificate.
General Obligations	Sub-Clause 8.1 Detail of Erection and Testing Equipment and Maintenance Tools is given herein below: **As per requirement of the tests to be carried out**
Programme to be Furnished	Sub-Clause 12.1. The Programme must be submitted in the form of **Bar-Chart with critical path/activities for individual activities and overall Project within 15 days from the date of commencement.**
Electricity Water, Gas and Other Services	Sub-Clause 14.3. Supplies on the Site are: a. Electricity: b. Water: c. Gas: d. Other Services: } Refer to Sub-Clause 14.3 in Particular Conditions of Contract
Employer's Equipment	Sub-Clause 14.4. The following Employer's equipment is available for use by the Contractor under the Employer's operation: **There will be no Employer's Equipment available for use by the Contractor.**
Working Hours	Sub-Clause 18.3. The normal working hours are **on the Site are to conform to the applicable labour laws and the existing customs of Pakistan.**
Time for Completion	Sub-Clause 25.1 (i) Place of the Project: **Quaid-e-Azam Business Park (QABP) Sheikhupura** (ii) Period **of Completion is as stated under Sub-Clause 1.1.35 hereof.**
Earlier Completion	Sub-Clause 26.3 (i) Amount of Bonus per day: **NIL** (ii) Max. Amount of Bonus: **NIL**
Delay in Completion	Sub-Clause 27.1. Failure to meet the Time for Completion entitles the Employer to reduction in Contract Price as follows: Percentage per day **the liquidated damages @ 0.10 % percent of the Contract Price as stated in Letter of Acceptance, excluding Provisional Sums for each and every day, including holidays, of delay or part thereof:** but to a maximum **limit of 10 % of the Contract Price as stated in Letter of Acceptance, excluding Provisional Sums.**
Prolonged Delay	Sub-Clause 27.2. Maximum amount recoverable from the Contractor by the Employer **shall be 10% of Contract Price as stated in the Letter of Acceptance, excluding Provisional Sum or 100% of the Contract value of the part of the works that cannot be put to its intended use by reason of delays whichever is greater.**
Terms of Payment	Sub-Clause 33.1.

	In addition to the provisions under Clause 33, the terms of payment shall be as stated in Particular Conditions of Contract.
Payment	Sub-Clause 33.5 (i) Period of Payment by Employer to Contractor: **14 days** (ii) Period of Final Certificate of Payment: **30 days**
Payment in Foreign Currencies	Sub-Clause 35.1. Payment in foreign currencies shall be arranged as follows: *[Employer may change it]*. **Refer to Sub-Clause 35.1 in Particular Conditions of Contract**
Insurance of Works	Sub-Clause 43.1. The deductible limits in the insurance cover of the Works shall not exceed **the total amount of the contract.** Sub-Clause 43.1.(a) The additional risks to be insured are: **as stated in Sub-Clause 43.1(a) of the Particular Conditions of Contract.**
Third Party Liability	Sub-Clause 43.3. Deleted
Payment on Termination for Employer's Default	Sub-Clause 46.3. The additional amount payable by the Employer on termination shall not exceed: **the actual cost of work executed.**
Labour, Materials and Transport	Sub-Clause 47.1. The Clause is deleted in entirity
Notices to Employer and Engineer	Sub-Clause 49.2. The address of the Employer for notices is: **the same as given in Sub-Clause 1.1.12 here above.** The address of the Engineer for notices is: **the same as given in Sub-Clause 1.1.15 here above.**
Disputes & Arbitration	Sub-Clause 50.4 Venue of Arbitration **PIEDMC Head Office, Sundar Industrial Estate, Raiwind Road Lahore,** Pakistan.
Applicable Law	Sub-Clause 51.1. The applicable law is **The Contract in all respects be read and construed and shall operate as a Pakistani Contract in conformity with the Laws of Islamic Republic of Pakistan.** law.
Procedural Law for Arbitration	Sub-Clause 51.2. The procedural law for arbitration is **the Rules of Pakistan Arbitration Act 1940 as amended.**
Language and Place of Arbitration	Sub-Clause 51.3. The language of arbitration is **English** language. The place of arbitration is **PIEDMC Head Office, Sundar Industrial Estate, Raiwind Road Lahore.**

GENERAL CONDITIONS OF CONTRACT

(a) General Conditions of Contract
(b) Particular Conditions of Contract

The **"CONDITIONS OF CONTRACT FOR ELECTRICAL AND MECHANICAL WORKS"** section from page 71-141 has been removed as FIDIC doesn't allow it to be copied. Download the PDF version of this document from PICC website to view it completely OR Copies of the FIDIC Conditions of Contract can be obtained from:

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1000 Lausanne 12
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PART-II: PARTICULAR CONDITIONS OF CONTRACT

PART-II: PARTICULAR CONDITIONS OF ONTRACT

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PART-II: PARTICULAR CONDITIONS OF CONTRACT

1.1 Definitions

The text of Sub-Clause 1.1.1 is deleted and substituted by the following:

"Commencement Date" means the date specified in the Preamble to Conditions of Contract.

The text of Sub-Clause 1.1.2 is deleted and substituted by the following:

"Conditions" means the Preamble to Conditions of Contract, General Conditions of Contract and Particular Conditions of Contract.

Sub-Clause 1.1.3

At the end of Sub-Clause the following is added:
"Any subsequent document mutually agreed and signed by the Employer and the Contractor, shall be the part of the Contract."

The text of Sub-Clause 1.1.5 is deleted and substituted by the following:

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

Sub-Clause 1.1.11

The Defects Liability Period is the period mentioned in the Preamble to Conditions of Contract.

Sub-Clause 1.1.15

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

"or any other competent person appointed by the Employer as his replacement."

Sub-Clause 1.1.23

The following paragraph is added:

The word "Goods" is synonymous with "Plant."
The text of Sub-Clause 1.1.27 is deleted and substituted by the following:

"Schedule of Prices" means the completed and priced Schedule of Prices, or any part or individual schedule thereof, submitted by the Contractor with his Bid or revised and mutually agreed and forming a part of the Contract documents.

Sub-Clause 1.1.33

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

The following Sub-Clauses are added:

"1.1.38 "Month" means calendar month according to Gregorian calendar.
1.1.39 "Operation and Maintenance Manuals" has the meaning described in Sub-Clause 6.6.
1.1.40 "Warranty Certificate" means the certificate against specified goods/equipment, for the period mentioned in the Preamble to Conditions of Contract, to be issued by the Contractor that the goods/equipment supplied under the Contract are new, unused and incorporate all recent improvements in design and materials unless provided otherwise in the Contract and that the Contractor will be responsible for making good or replacing any defective goods/equipment during the Warranty Period specified in the Preamble to Conditions of Contract which should commence after expiry of Defect Liability Period.

Sub-Clause 1.1.41

The word "Part II" stated in FIDIC Conditions of Contract is synonymous with the word "Particular Conditions of Contract".

Sub-Clause 1.6 Cost, Overhead Charges and Profit

The last sentence "Any profit _____ stated in the Preamble" is deleted and substituted by the following:
"Any profit entitlement shall be added to cost at the percentage stated in the Bid and agreed in the Contract Agreement."

Sub-Clause 2.1 Engineer's Duties

The text of Sub-Clause 2.1 is deleted and substituted by the following:

"The Engineer shall carry out the duties specified in the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. The Engineer is required to obtain the specific approval of the Employer before carrying out his duties in accordance with the following Clauses of General Conditions of Contract:

(a) approval of Subcontractor under Sub-Clause 4.1,
(b) certifying additional sums under Sub-Clause 5.4,
(c) certifying additional costs under Sub-Clauses 11.3 & 12.3,
(d) certifying any cost under Sub-Clause 14.6,
(e) approval of extension of time under Clause 26,
(f) issuing a Taking–Over Certificate under Sub-Clause 29,
(g) issuing a Defects Liability Certificate under Sub-Clause 30.11,
(h) issuing a Variation Order under Clause 31,
(i) fixing rates or prices under Clauses 31 and 34,
(j) certifying additional costs under Sub-Clause 44.5 and
(k) certifying additional costs under Sub-Clause 47.2;

Except for such variations pursuant to Sub-Clause 31.1 of the GCC which may be necessary in an emergency affecting safety of life, the works or of adjoining property."

Except as expressly stated in the Contract the Engineer shall have no authority to relieve the Contractor of any of his obligations under this Contract."

Sub-Clause 2.6 Confirmation in Writing

(i) In line 3 after the words "undue delay" the following is added:
"but not after the number of days mentioned in the Preamble to Conditions of Contract from the instruction or decision."

(ii) At the end of Sub-Clause 2.6, the following is added:
"The Engineer shall confirm or otherwise within the period mentioned in the Preamble to Conditions of Contract from the receipt of requirement(s) from the Contractor."

Sub-Clause 2.7 Disputing Engineer's Decisions and Instructions

The following text is deleted:
"If either party ……. in accordance with the Contract."

Sub-Clause 2.8 Replacement of Engineer

The text of Sub-Clause 2.8 is deleted and substituted by the following:

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

Sub-Clause 2.9 Engineer Not Liable

Sub-Clause 2.9 is added as follows:

"Approval, reviews and inspection by the Engineer of any part of the Works does not relieve the Contractor from his sole responsibility and liability for the supply of remaining materials and equipment for the Works and parts thereof and complete the remaining erection works and testing and commissioning in accordance with the Contract and neither the Engineer's authority to act nor any decision made by him in good faith as provided for under this Contract whether to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any of their representatives or employees or any other person performing any of the works. However the Contractor shall be compensated if any loss/damage is occurred due to the decision of the Engineer."

Sub-Clause 4.2 No Contractual Relation between Subcontractor and the Employer

Sub-Clause 4.2 is added as follows:

Nothing contained in the Contract Documents shall create any contractual relation between any Subcontractor and the Employer.

Sub-Clause 5.3 Priority of Contract Documents

Sub-Clause 5.3 is deleted and substituted by the following:

"Unless otherwise provided in the Contract the priority of the Contract Documents shall be as follows:

1. The Contract Agreement (if completed)
2. The Letter of Acceptance
3. The completed Form of Bid
4. Preamble to Conditions of Contract
5. The Particular Conditions of Contract
6. The General Conditions of Contract
7. The priced Schedule of Prices
8. The completed Schedules to Bid
9. The Specifications
10. The Drawings
11. ……(Any other document)

In case of discrepancies between drawings, those of larger scale shall govern unless they are superseded by drawing(s) of a later date regardless of scale. All drawings and specifications shall be interpreted in conformity with the Contract Agreement and these conditions."

The Contractor must provide Six (06) copies of "The Contract Documents" to the Employer/Client.

Sub-Clause 5.4 Documents Mutually Explanatory

The text appearing in the last line after the words "the Contract Price" is deleted. ***and the following text is added:***

"The Technical Specifications are taken to be correct, but complete accuracy is not guaranteed. Any error or ambiguity must be reported to the Employer and "The Engineer" before starting the work affected. In the event of any dispute arising as to the true intended meaning of Technical Specification, "The Engineer" shall interpret the same and his interpretation shall be accepted as final and binding upon all parties concerned, except to the extent provided for in the Arbitration provisions hereof."

Type Test Reports

The required valid Type test reports (acceptable to NTDC) shall be submitted along with the Bidding Documents.

For the specified requirement of Type Test and Type reports, the following Labs will be considered as Internationally Accredited Independent Labs (IAIL):-

(a) KEMA Lab, Holland;
(b) CESI Lab, Italy;
(c) CRIEPI Lab, Japan;
(d) HV & SC Testing Lab, Rawat, Pakistan;
(e) Any Laboratory accredited by EA (European Co-operation for accreditation) or a member there of;
(f) Any Laboratory accredited by ILAC (International Lab accreditation) or a member there of;
(g) Any Laboratory accredited by IAF (International accreditation Forum) or a member there of;
(h) Any Laboratory accredited by STL (Short Circuit Testing Liaison) or a member there of;

Sub-Clause 6.2 Consequences of Disapproval of Contractor's Drawings

Full stop is deleted and the following words are added at the end of Sub-Clause:
"for the approval of the Engineer. However, the Contractor shall not be entitled for time extension on this account."

Sub-Clause 6.6. Operation and Maintenance Manuals

Paras 2&3 are deleted and the following text is added at the end of Para 1 of Sub-Clause:

"The Operation and Maintenance Manuals shall include full instructions for the operation, servicing and maintenance of the Plant, not only during the period of the Contractor's liability but more particularly during its operating life.

The directions shall be set out simply, clearly and systematically. This may be divided into two volumes if desirable, one for operation and the second for servicing and maintenance (in sub–volumes for major items of Plant).

The operational data shall include a complete physical and functional description of the Plant (in sub–volumes for major items of Plant) and step–by–step procedures for inspection, checking and adjustments for proper operation of the Plant.

The maintenance data shall include complete instructions for routine checks, servicing, maintenance and repair of all parts and for dismantling, handling and re–assembly of all equipment, sub–assemblies and all separate components. The maintenance data shall also include where possible parts catalogues The lists shall provide all necessary information for identifying the parts and for re–ordering the parts including name of part, part number and catalogue references where applicable, name of manufacturer, size, capacity and other characteristics .

General arrangements, single line diagrams and detailed drawings shall be provided for ready reference in the operation and maintenance instructions.

The manuals shall be printed on ISO paper size A4 (210x297 mm) with offset or equivalent printing strongly bound in a durable stiff cover bearing the title in approved legend. Drawings shall be folded or reduced to 297 mm height. All volumes shall bear on the spine an approved shortened version of the title.

The Contractor shall submit three draft copies for approval of the Engineer prior to producing finished volumes.

The Contractor shall provide ten (10) copies of the approved Operation and Maintenance Manuals prior to Taking Over by the Employer. Supplementary Operation and Maintenance Manual shall be provided by the Contractor, if required, to incorporate changes resulting from experience during the operation and maintenance period. The work shall not be considered to be completed for the purpose of taking over until such manual and drawings have been supplied to the Employer."

Sub-Clause 6.9 Manufacturing Drawings

The words "Unless otherwise specified in Part-II" are deleted and the following is added at the end of Sub-Clause:

"However, the Contractor is required to disclose to the Engineer or the Employer any confidential information necessary to justify the reliability, the efficiency and the operation and maintenance of the Plant supplied by him."

Sub-Clause 6.10 "As–Built" Drawings

The following new Sub-Clause is added:

The Contractor shall furnish to the Engineer six (6) copies and one (1) reproducible of approved quality of all "As–Built" drawings within the period mentioned in the Preamble to Conditions of Contract. ***All drawings shall also be provided in an electronic form (CD/USB).***

Sub-Clause 8.1 General Obligations

The text of Sub-Clause 8.1 is deleted and substituted by the following:

"(a) The Contractor shall commence the work on the date specified in the Preamble to Conditions of Contract and shall proceed with the same with due expedition and without delay.

(b) The Contractor shall, in accordance with the Contract, with due care and diligence, complete the Works and test and commission the Plant and carry out the Works within the Time for Completion. The Contractor shall also provide all necessary Contractor's Equipment, superintendence, labour and except as stated hereinbelow, all necessary facilities therefor.

The Employer will permit use of the Erection, Testing Equipment and Maintenance Tools as stated in the Preamble to Conditions of Contract.

The above facilities shall be provided at no cost to the Contractor but he shall procure at his cost all required consumable materials and any other items necessary for the proper execution of the Works. These shall be properly used and maintained by the

Contractor and returned to the Employer upon handing over of the Works in good condition, fair wear and tear excepted. In case of any damage, loss or theft, the items shall be replaced by the Contractor at his own cost."

Sub-Clause 10.1 Performance Security

Sub-Clause 10.1 is deleted and substituted by the following:

"The Contractor shall provide a Performance Security ***till the expiry of Decfect Liability Period*** in the prescribed Form annexed to these Documents. The said Security shall be furnished by the Contractor within 14 days after the receipt of Letter of Acceptance. The Performance Security shall be of an amount equal to ***10%*** of the Contract Price in the currency (ies) of the Contract at the option of the bidder, in the form of **Bank Guarantee from any Scheduled Bank in Pakistan.**

The cost of complying with the requirements of this Sub-Clause shall be borne by the Contractor." ***If the Performance Guarantee is not provided within specified time, the contract shall deemed to be terminated.***

Sub-Clause 10.3 Claims under Performance Security

Sub-Clause 10.3 is deleted in its entirety.

The following Sub Clause is added:

Sub-Clause 10.4 Performance Security Binding on Variations and Changes

"The Performance Security shall be binding irrespective of variations and changes in the quantities of the Works or extensions in completion time of the Works, which are granted or agreed upon under the provisions of the Contract."

Sub-Clause 12.1 Programme to be Furnished

Sub-Clause 12.1(a) is deleted and substituted by the following:

"(a) the order in which the Contractor proposes to carry out the Works (including preliminaries, required material ordering, delivery to Site, erection and rectifications work, testing, commissioning and taking–over by the Employer). The programme shall also include the following:

(i) Employment of local and expatriate labour of various categories,

(ii) Local material procurement,

(iii) Material imports, if any."

In Sub-Clause 12.1(c)(iv) the words “any import licenses” are deleted.

Sub-Clause 12.4 Monthly Progress Report

The following Sub-Clause 12.4 is added:

“During the period of the Contract, the Contractor shall submit six sets of report to the Engineer not later than the 8th day of each month, including:

(i) a construction schedule indicating the progress achieved during the preceding month;

(ii) description of all work carried out since the last report;

(iii) description of the work planned for the next forty two days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing;

(iv) summary of daily job record for the preceding month; and

(v) colour photographs to illustrate progress.

Sub-Clause 12.5 Daily Job Record

The following Sub Clause 12.5 is added:

“During the period of the Contract, the Contractor shall keep a daily record of the work progress, which shall be made available to the Engineer as and when requested.

The daily record shall include particulars of weather conditions, number of men working, in different categories, deliveries of materials, quantity, location and assignment of equipment.”

Sub-Clause 13.1 Contractor's Representative

At the end of the Sub-Clause the following is added:

“The Contractor's Representative shall be a competent and skilled person approved by the Engineer (which approval may at any time be withdrawn) and who shall be present on the Site during all working hours. He shall be fluent in the English language. He shall not be transferred from the Site without the consent of the Engineer. The Contractor's Representative shall be a Registered/Professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976).”

Sub-Clause 13.3 Language Ability of Superintending Staff of Contractor

The following Sub-Clause 13.3 is added:

“A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of the English language.”

Sub-Clause 13.4 Employment of Local Personnel

The following Sub-Clause 13.4 is added:

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

Sub-Clause 14.1 Contractor's Equipment

Replace the word "or" at the end of Sub-paragraph (a) by the word "and" and insert the following at the end of Sub-paragraph(b):

"which shall not be unreasonably withheld."

Sub-Clause 14.2 Safety Precautions

At the end of the Sub-Clause the following is added:

"In order to provide for the safety, health and welfare of persons, and for prevention of damage of any kind, all operations for the purposes of or in connection with the Contract shall be carried out in compliance with the safety requirements of the Government of Pakistan with such modifications thereto as the Engineer may authorise or direct and the Contractor shall take or cause to be taken such further measures and comply with such further requirements as the Engineer may determine to be reasonably necessary for such purpose.

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

Sub-Clause 14.3 Electricity Water and Gas

The text of Sub-Clause 14.3 is deleted and substituted by the following:

"The Contractor shall be responsible for making his own arrangements for the adequate supply of electricity, water and gas required for the effective performance of his obligations under the Contract. Subject to the aforesaid, the Contractor shall be entitled to use for the purposes of the Works such supplies and services as may be available on the Site. The Contractor shall, before the commencement of the work at Site, seek the approval of the Engineer as to his detailed requirements of electricity, water and gas for the entire Contract period. The Contractor shall pay the Employer at the rates/cost incurred by the Employer. The Contractor shall at his own cost provide any apparatus necessary for such use."

Sub-Clause 14.4 Employer's Equipment

The text of Sub-Clause 14.4 is deleted and substituted by the following:

"The Employer shall, if the Contractor so requests for the execution of the works,

operate any available equipment of which details are given in the Preamble to Conditions of Contract. The Contractor shall pay the Employer a mutually agreed price for such use.

The Employer shall during such operation retain control of and be responsible for the safe working of the equipment.

Sub-Clause 14.8 Information for Import Permits & Licences

The text of Sub-Clause 14.8 is deleted and substituted by the following:

"The Contractor shall submit to the Employer in good time such details of all Plant and Contractor's Equipment as is to be imported into Pakistan and identify as to what assistance of the Employer is required for obtaining by the Contractor of all necessary import permits or licences."

Sub-Clause 15.2 Compliance with Laws

The Sub-Clause 15.2 is deleted and substituted by the following:
"The Contractor shall comply with the Laws of country of manufacture and the Laws of Pakistan where the Plant is to be erected."

Sub-Clause 16.4 Photographs of Works and Advertisement Prohibited

Sub-Clause 16.4 is added:

"Except with the prior written authorisation of the Employer the Contractor shall not exhibit or permit to be exhibited any photographs or advertisement on the Works. Any authorized exhibition shall be immediately removed if the Employer so requires."

Sub-Clause 16.5 Training of Employer's Staff

Sub-Clause 16.5 is added:

"The Contractor shall provide such facilities for the training of such numbers of Pakistani engineers, engineering students, apprentices and trade apprentices on such sections of the Works at the Site or on the Contractor's premises or Contractor selected plant manufacturer's premises and factories, or wherever else work is in hand, as specified or directed by the Engineer. The Employer shall direct what sums by way of wages and allowances are to be paid by the Contractor to such persons and shall reimburse the Contractor for such sums as are so directed to be paid and are paid. The Contractor shall also provide medical expenses or medical insurance and travelling expenses for trainees if required by the Employer which shall be reimbursed by the Employer.

The language of training at the above stated premises shall be English and Urdu."

Sub-Clause 17.4 Consents and Way Leaves

The Sub-Clause 17.4 is deleted and substituted by the following:

The Employer shall issue permissions, letters, certificates and provide such other assistance to the Contractor for his obtaining permits-to-work, way leaves and approvals from any other department/authority and right of way from private owners, if required. The Contractor will bear the cost of logistics, fees, etc. for such activities. The Employer, will reimburse the Contractor only the payments made by him in respect of any land compensation for obtaining such way leaves, required for the Works.

Sub-Clause 17.5 – Import Permits and Licences

The word "Employer" is deleted and substituted by the word "Contractor" and the following is added at the end of Sub-Clause 17.5:
"the Employer will provide assistance for this purpose."

Sub-Clause 18.1 – Engagement of Labour

At the end of the Clause the following is added:
"in accordance with the regulations, orders and requirements of the Govt. of Pakistan."

Sub-Clauses 18.5 to 18.12 are added:

"Sub-Clause 18.5 Employment of Persons in the Service of Others

The Contractor shall not recruit or attempt to recruit staff and labour from amongst the persons in the service of the Employer or the Engineer and vice–versa, unless mutually agreed between the Employer/Engineer and the Contractor

Sub-Clause 18.6 Alcoholic Liquor or Drugs

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

Sub-Clause 18.7 Arms and Ammunition

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

Sub-Clause 18.8 Festivals and Religious Customs

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

Sub-Clause 18.9 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any

unlawful riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection of persons and property in the neighbourhood of the Works.

Sub-Clause 18.10 Records of Safety and Health

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

Sub-Clause 18.11 Reporting of Accidents

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

Sub-Clause 18.12 Compliance by Subcontractors

The Contractor shall be responsible for compliance by his Subcontractors of the foregoing provisions."

Sub-Clause 19.1 Manner of Execution

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

"The Contractor shall submit for approval of the Engineer, his detailed method statement(s) for the execution of such items of work as may be desired by the Engineer. Approval of such method statement(s) shall neither relieve the Contractor of his responsibilities under the Contract nor form any basis for claiming additional costs."

Sub-Clause 19.3 Uncovering Work

The following is added at the end of second paragraph of Sub-Clause 19.3:

"In any other case, all costs shall be borne by the Contractor."

Sub-Clause 19.4 Use of Pakistani Materials

The following Sub-Clause 19.4 is added:

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

Sub-Clause 20.6 Witnessing of Factory Acceptance Tests (as applicable):

The following new Sub-Clause 20.6 is added:

Factory acceptance tests shall be witnessed by the personnel (one each) of the Employer,/ Engineer, Consultants, and the concerned DISCO. All costs in connection with witnessing of the factory acceptance tests by the three inspectors shall be borne by the Contractor. These shall include the costs of air travel (business class) from Pakistan to place of inspection,testing and back, hotel accommodation/boarding/lodging (as per actual), inland transportation and daily allowance @ €200 per day per person for inspection,testing to be conducted outside Pakistan and Rs.5,000 per day per person [besides other costs of travelling and lodging etc. (as above)] for inspection,testing to be conducted inside Pakistan for each visit of every person to witness these tests.

In case of local make Power Transformer, raw materials inspection as well as stage inspection will be carried out and witnessed by inspectors before and in addition to its Factory Acceptance Tests (FAT), Site Acceptance Tests (SAT) & Pre-commissioning Tests at the Contractor's own expense.

Sub-Clause 24.1 Cost of Suspension

At the end of the second paragraph after the word "Contractor" the following is added:

"or for the proper execution or for the safety of the Works or Plant unless such necessity results from any act or default of the Engineer or the Employer or in consequence of any of the Employer's Risks under Sub-Clause 37.2."

Sub-Clause 24.4 Resumption of Work

First paragraph of Sub-Clause 24.4 is deleted and substituted by the following:

"If the Contractor chooses not to treat prolonged suspension as an omission or termination under Sub-Clause 24.3, the Employer shall, upon the request of the Contractor, take over the responsibility for protection, storage, security and insurance of the suspended Works and of the Plant which has been delivered to the Site and which is affected by suspension and the risk of loss or damage thereto shall thereupon pass to the Employer."

Sub-Clause 25.1 Time for Completion

The text of Sub-Clause 25.1 is deleted and substituted by the following:

"The Works at the place of the project mentioned in the Preamble to Conditions of Contract shall be completed tested and commissioned within the period mentioned in the Preamble to Conditions of Contract."

Sub-Clause 26.1 Extension of Time for Completion
By the approval of "The Engineer".

Sub-Clause 26.3 Earlier Completion

(i) At the end of Sub-Clause 26.3(a) the following text is added and Clause is re-

designated as 26.3.

"The extra sum to be paid to the Contractor for Completion of Works prior to the date of Completion established under Sub-Clause 25.1 shall be computed on the basis of the sums mentioned in the Preamble to Conditions of Contract."

(ii) Sub-Clause 26.3 (b) is deleted.

"Sub-Clause 26.4 Rate of Progress

Sub-Clause 26.4 is added:

"If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to comply with the Time for Completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as to comply with the Time for Completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Sub-Clause, involve the Employer in additional supervision costs, such costs shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any moneys due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer."

Sub-Clause 27.1 Delay in Completion

Sub-Clause 27.1 is deleted and substituted by the following:

"If the Contractor fails to deliver the Works, or any part thereof, within the time stated in Sub-Clause 25.1, or fails to complete the whole of the Work, or, if applicable, any Section within the relevant time prescribed by Sub-Clause 25.1, then the Contractor shall pay to the Employer the relevant sum stated hereinbelow as liquidated damages for such default (which sum shall be the only moneys due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant time for Delivery or Time for Completion and the actual date of delivery at site or the date stated in a Taking–Over Certificate of the whole of the Works or the relevant Section, as the case may be, subject to the applicable limit stated hereinbelow.

The Employer may deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations & liabilities under the Contract."

The liquidated damages for each day of delay and the maximum amount of liquidated

damages shall be the amounts mentioned in the Preamble to Conditions of Contract.

Sub-Clause 28.7 Consequences of Failure to Pass Tests on Completion

The words "by arbitration" appearing at the end of the Sub-Clause 28.7(c) are deleted and substituted by the words "by the Engineer".

Sub-Clause 30.4 Extension of Defects Liability Period

At the end of 4th paragraph of Sub-Clause the following is added:
"or a mutually agreed period."

Sub-Clause 30.5 Failure to Remedy Defects

In first line after the words "reasonable time" the following is added:
"fixed by the Engineer".

Sub-Clause 30.13 Unfulfilled Obligations

New Sub-Clause 30.13 is added as herein below:

"After the Defects Liability Certificate has been issued, the Contractor and the Employer shall remain liable for the fulfillment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force."

Sub-Clause 31.1 Engineer's Right to Vary

The following is added at the end of second paragraph:

"No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 31. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of Contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor."

Sub-Clause 31.5 Record of Costs

The word "Engineer" in 4th line of Sub-Clause is deleted and substituted by "Engineer/Employer".

Sub-Clause 31.6 Daywork under Variation Order

New Sub-Clause 31.6 is added as given below:

"A Variation Order may provide that work done pursuant thereto shall be executed as Daywork. In such case the Contractor shall be paid for such work under the conditions and the rates and prices set out in the Day Work Schedule."

Sub-Clause 31.7 Value Engineering

New Sub-Clause 31.7 is added as given below:

The Contractor may, at any time, submit to the Engineer a written proposal which in the Contractor's opinion will reduce the cost of constructing, maintaining or operating the works, or improve the efficiency or value to the Employer of the completed Works or otherwise be of benefit to the Employer. Any such proposal shall be prepared at the cost of the Contractor. However Employer is not bound to accept such proposal.

Sub-Clause 33.1 Terms of Payment

The text of Sub-Clause 33.1 is deleted and substituted by the following:

Unless otherwise agreed the Contractor shall be paid in the following manner, the Contract Price, adjusted to give effect to such additions thereto and such deductions therefrom as are provided in the Contract.

(i) Plant,Equipment and mandatory spare parts with Installation

- Eighty Five percent (85%) of the total amount or part thereof for Schedule-2(b) upon delivery at site, within Fifteen (15) days after receipt of invoice
- Five percent (05%) of the total amount for Schedule-2(b) upon Installation, Testing and Commissioning of the equipment
- Five percent (05%) of the total amount for Schedule-2(b) upon issue of the Taking Over Certificate, within fifteen (15) days after receipt of invoice.
- Five percent (05%) of the total for Schedule-2(b) upon issue of the Defect Liability Certificate, within fifteen (15) days after receipt of invoice.

(ii) Civil Works

- Eighty percent (85%) of the measured value of work performed by the Contractor, as identified in the said Program of Performance, during the preceding month, as evidenced by the Employer's authorization of the Contractor's application, will be made monthly within fifteen (15) days after receipt of invoice.
- Five percent (5%) of the total or pro rata value of Civil Works performed by the Contractor as evidenced by the Employer's authorization of the Contractor's monthly applications, upon issue of the Operational Acceptance Certificate, within forty-five (45) days after receipt of invoice.
- Five percent (05%) of the total amount for Schedule-2(c) upon issue of the Taking Over Certificate after energization of system, within forty-five (45) days after receipt of invoice.

- Five percent (05%) of the total for Schedule-2(c) upon issue of the Defect Liability Certificate, within forty-five (45) days after receipt of invoice.

The following Sub-Clauses are added:

Sub-Clause 33.1.1 Retention of Payment

If at any time any payment would fall due for Works or part of Works and, if there shall be any defect in part of such Works in respect of which such payment is proposed, the Employer may retain the whole or any part of such payment. Any sum retained by the Employer pursuant to the provisions of this Clause shall be paid to the Contractor after the said defect is removed.

Sub-Clause 33.1.2 Payment Where Taking-Over Certificate Issued for Section or part of Works

If any section or part of the Works shall be taken-over separately under Clause 29 (Taking-Over) hereof, the payments herein provided for on or after Taking-Over shall be made in respect of the section or part taken-over and reference to the price shall mean such part of the price as shall, in the absence of agreement, be apportioned thereto by the Engineer.

Sub-Clause 33.2 Method of Application

(Employer may vary this Sub-Clause)

Sub-Clause 33.5 Payment

Sub-Clause 33.5 is deleted and substituted by the following:

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 27, be paid by the Employer to the Contractor within 15 days after such Interim Payment Certificate has been jointly verified by Employer and Contractor, or, in the case of the Final Certificate referred to in Sub-Clause 33.10 within 30 days after such Final Payment Certificate has been jointly verified by Employer and Contractor; Provided that the Interim Payment shall be caused in 42 days and Final Payment in 30 days in case of foreign funded project.

Deduction shall be made from the net amounts payable to the Contractor of any sum(s) in accordance with the prevalent Federal and/or Provincial laws, provided that no such deduction shall be made from those payments in respect of which the Contractor has obtained exemption under the Law."

Sub-Clause 33.6 Delayed Payment

NOT APPLICABLE

Sub-Clause 33.8 Payment by Measurement

The work shall be measured for the units mentioned in the Schedule of Prices according to the Contract as determined by the Engineer from approved drawings, Specifications and Contract Documents.

Sub-Clause 33.12 Withholding of Payment

New Sub-Clause 33.12 is added as given below:

If the Works or any part thereof are not being carried out to the Engineer's satisfaction and in order to protect the Employer from loss on account of:

(a) defective work not rectified
(b) guarantees not met
(c) claims filed against the Contractor
(d) failure of the Contractor to make payments due for Plant procured or labour employed by him.
(e) damage to any other contractor employed by the Employer.
(f) Contractor's non–compliance with the Contract
(g) any Government dues recoverable from the Contractor if notified by the Government

The Engineer may notify withholding of such payments or part thereof as may, in his opinion, be related to the aforesaid reasons/grounds. When the reasons/grounds for withholding the payment are removed by the Contractor, the Engineer shall upon being satisfied to that effect issue Certificate of Payment in respect of withheld amounts.

Sub-Clause 35.1 Payment in Foreign Currencies

Payment shall be made only in Pak Rupees.

Sub-Clause 35.2 Currency Restrictions

The text of Sub-Clause 35.2 is deleted and substituted by the following:

"Any required foreign currency transactions shall be met by the Employer/Contractor at his cost from his own resources."

Sub-Clause 35.3 Rates of Exchange

The words "as stated in the Preamble" appearing in 3rd line of Sub-Clause are deleted and substituted by the words "as published or authorized by State Bank of Pakistan".

Sub-Clause 36.4 Payment against Provisional Sums

Sub-Clause 36.4 is deleted and substituted by the following:

"Provisional Sum if any will be expended on the direction of the Engineer through Variation Orders which would be valued in accordance with the provisions of Clause

31 Conditions of Contract."

Sub-Clause 37.2 Employer's Risks

The text of Sub-Clause 37.2 is deleted and substituted by the following:

"The Employer's Risks are:

(a) (Insofar as they relate to Pakistan) war and hostilities (whether war be declared or not), invasion, act of foreign enemies

(b) (Insofar as they relate to Pakistan) rebellion, revolution, insurrection, military or usurped power or civil war

(c) ionizing radiation or contamination by radioactivity from any nuclear fuel, radio-active toxic explosives or other hazardous properties of any explosive nuclear assembly or nuclear components thereof

(d) pressure waves caused by aircraft travelling at sonic or supersonic speed

(e) (Insofar as they relate to Pakistan) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors

(f) use or occupation of the Work or any part thereof by the Employer

(g) fault, error, defect or omission in the design of any part of the Works by the Engineer, Employer or those for whom the Employer is responsible for which the Contractor has disclaimed responsibility in writing within a reasonable time after the receipt of such design

(h) the use or occupation of the Site by the Works or any part thereof, or for the purposes of the Contract: or interference, whether temporary or permanent with any right of way, light, air or water or with any easement, way leaves or right of a similar nature which is the inevitable result of the construction of the Works in accordance with the Contract

(i) the right of the Employer to construct the Works or any part thereof on, over, under, in or through any land

(j) damage (other than that resulting from the Contractor's method of construction) which is the inevitable result of the construction of the Works in accordance with the Contract

(k) the act, neglect or omission or breach of contract or of statutory duty of the Engineer, the Employer or other contractors engaged by the Employer or of their respective employees or agents."

Sub-Clause 39.2 Loss or Damage Before Risk Transfer Date

The words "by arbitration under Clause 50" are deleted and substituted by the words "by the Engineer".

Sub-Clause 39.4 Duty to Minimize Delay

New Sub-Clause 39.4 is added as given below:

Each Party shall at all times use all reasonable endeavours to minimize any delay in the Performance of the Contract as a result of Risks.

The Contractor shall give notice to the Employer and vice versa the Employer shall give notice to the Contractor in case of foreseeable delay by the Risks.

Sub-Clause 40.2 Employer's Liability

The text of Sub-Clause 40.2 from the words "or of death or personal injury" to the end of the Sub-Clause, is deleted and substituted by the following:

"..... (other than the Works) or of death or personal injury to the extent caused by any of the Employer's Risks listed in paragraphs (f), (g), (h), (i), (j), and (k) of Sub-Clause 37.2 but not otherwise."

Sub-Clause 42.2 Maximum Liability

the words "the sum stated in the Preamble to Conditions of Contract or if no such sum is stated" appearing in 2nd line of Sub-Clause are deleted.

Sub-Clause 42.6 Foreseen Damage

Sub-Clause 42.6 is deleted in its entirety.

Sub-Clause 43.1 The Works (Insurance)

The other risks to be insured by the Contractor upto issuance of Taking Over Certificate (TOC) are:

(i) Fire, smokes, explosion, falling objects, earthquake, perils of the sea, tempest, impact by aircraft or land vehicle, aircraft and other aerial devices or articles dropped therefrom, lightning, strike, riot, civil commotion, escape of water, inundation, rain, snow, land slides, flood, act of God, vandalism or malicious damage, windstorm or hail storm.

(ii) Collision, upset, overturn, derailment, stranding or sinking of an automobile or any conveyance of a common carrier by land, water or air in which the Plant or any part thereof is being carried including overland transportation in Pakistan from port of entry to the Site.

(iii) Theft, burglary or attempted theft or burglary.

(iv) Any loss or damage during pre-erection storage.

(v) Faults in construction and erection, lack of skill, lack of experience, negligence, malicious act.

(vi) any other sudden and unforeseen event such as loss or damage due to collapse etc. on site, transport of items to be erected.

(vii) Actions of the Employer in the operation of plant or part thereof on behalf of the Contractor.

Sub-Clause 43.2 Contractor's Equipment

Sub-Clause is deleted

Sub-Clause 43.3 Third Party Liability (Insurance)

(Employer may vary this Sub-Clause)

Sub-Clause 43.7 Remedies on the Contractor's Failure to Insurer

Sub-Clause is deleted.

Sub-Clause 43.11 Procurement of Insurance Policies

Sub-Clause is deleted

Sub-Clause 44.6 Damage Caused by Force Majeure

At the end of the Sub-Clause 44.6 the following is added:

"However the Contractor shall put up his claim to the Employer / Engineer with full details and justification."

Sub-Clause 44.8 Payment on Termination for Force Majeure

Text in sub-para (c) is deleted and para (d) and (e) are re-numbered as (c) and (d).

Sub-Clause 44.10 Force Majeure Affecting Engineer's Duties

Sub-Clause 44.10 is deleted in its entirety.

Sub-Clause 45.2 Contractor's Default

The following paragraph is added at the end of Sub-Clause 45.2.

"The Employer or such other contractor may use for such completion any Contractor's Equipment which is upon the Site as he or they may think proper, and the Employer

shall pay the Contractor a reasonable compensation for such use".

Sub-Clause 45.6 is added as follows:
Sub-Clause 45.6 Integrity Pact

If the Contractor, or any of his Subcontractors, agents or servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Schedule-H to his Bid, then the Employer shall be entitled to:

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

The termination under Sub-Para (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clauses 45.2 to 45.5 and the payment under Sub-Clause 45.4 shall be made after having deducted the amounts due to the Employer under Sub-Para (a) and (c) of this Sub-Clause.

Sub-Clause 46.1 Employer's Default

The comma and the word "or" at the end of paragraph (d) of Sub-Clause 46.1 are deleted and substituted by period (.) Paragraph (e) of Sub-Clause 46.1 is deleted.

Sub-Clause 46.3 Payment on Termination for Employer's Default

The words "including loss of profit" in the second paragraph of Sub-Clause 46.3 are deleted.

Sub-Clause 47.1 Labour, Materials and Transport

The Clause 47.1 of General conditions is deleted in it's entirety and replaced with the following:

"The contract prices are to remain firm & fixed for the duration of the contract and for the extension period (if any).No Escalation will be given to contractor"

Sub-Clause 48.1 Customs and Import Duties

The rates and prices quoted by the Contractor in the Schedule of Prices shall be deemed to have included (i) business taxes, income tax, super tax, customs, import duties and other taxes on income, and (ii) fees charged for services provided under this Contract. The taxation is leviable as per income tax ordinance 2001 issued by FBR Government of Pakistan including adjustment in prices as per clause 47.

Sub-Clause 48.3 Port Charges and Port Congestion

The Sub-Clause 48.3 is added:

The Contractor shall be deemed to have obtained all the information regarding facilities and charges, in respect of port clearance, loading and unloading, storage, transportation, congestion and confirmed the requirements thereof at his own responsibility and all such costs and charges are deemed to be included in the rates and prices of the Schedule of Prices.

Sub-Clause 49.1 Notice to Contractor

The following is added at the end of Sub-Clause 49.1:

"For the purposes of Sub-Clause 49.1 the Contractor shall, immediately after receipt of Letter of Acceptance, intimate in writing to the Employer and the Engineer by registered post, the address of his principal place of business or any change in such address during the period of the Contract."

Sub-Clause 50 Disputes & Arbitration

Clause 50 is deleted and in its place the following Sub-Clauses 50.1 to 50.5 are inserted:

"50.1 If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the fifty sixth (56) day after the day on which he received such reference, the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

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

In any case where the Conditions of Contract provide that the decision of the Engineer is to be final and conclusive, such decision shall not be referable to arbitration under this Clause nor shall the same be questioned in any other form of proceedings whatsoever.

50.2 If either the Employer or the Contractor be dissatisfied with a decision of the Engineer or if the Engineer fails to give notice of his decision on or before the fifty sixth (56) day after the day on which he received the reference, then

either the Employer or the Contractor may, on or before the twenty eighth (28) day after the day on which the said period of fifty six (56) days expired, as the case may be, give notice to the other party to commence arbitration, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 50.5, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notification of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the twenty eighth (28) day after the day on which the parties received notice as to such decision from the Engineer the said decision shall become final and binding upon the Employer and the Contractor.

50.3 Where notice of intention to commence arbitration as to a dispute has been given in accordance with Sub-Clause 50.2, arbitration of such dispute shall not be commenced unless an attempt has first been made by the parties to settle such dispute amicably through mutual negotiation within ninety (90) days from the date of notification of Engineer's decision.

50.4 Any dispute in respect of which:

(a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub-Clause 50.1 and

(b) amicable settlement has not been started/reached within the period stated in Sub-Clause 50.3

shall be finally settled, unless otherwise specified in the Contract, under the Pakistan Arbitration Act, 1940 (Act No. X of 1940) and Rules made thereunder as amended, by one or more arbitrators appointed under such Rules.

The said arbitrator(s) shall have full power to open up, review and revise any decision, opinion, instruction, determination, certificate or valuation of the Engineer for the purpose of obtaining said decision pursuant to Sub-Clause 50.1. No such decision shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

The venue of arbitration proceedings shall be the place in Pakistan as mentioned in the Preamble to Conditions of Contract.

50.5 Where neither the Employer nor the Contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 50.1 or 50.2 and the related decision has become final and binding, either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with Sub-Clause 50.4. The provisions of Sub-Clauses 50.1 to 50.2

shall not apply to any such reference."

STANDARD FORMS

STANDARD FORMS

Standard Forms include the following:

- Form of Bid Security
  (Bank Guarantee)
- Form of Contract Agreement
- Form of Performance Security
  (Bank Guarantee)
- Form of Bank Guarantee/Bond for Advance Payment

FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor (Bank) with address:_____
Name of Principal (Bidder) with address:_____
_____
Penal 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 "Employer") in the sum stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Bid numbered and dated as above for _____ (Particulars of Bid) to the said Employer; and

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

(1) that the Bid Security shall remain valid for a period 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 24.2 of Instructions to Bidders, or

(c) failure of the successful bidder to

(i) furnish the required Performance Security, in accordance with Clause 34 of Instructions to Bidders, or

(ii) sign the proposed Contract Agreement, in accordance with Clause 35 of Instructions to Bidders,

then the entire sum be paid immediately to the said Employer as liquidated damages and not as penalty for the successful bidder's failure to perform.

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

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

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

IN WITNESS WHEREOF, the above bounden 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: Signature _____

1. _____ Name _____

_____ Title _____
Corporate Secretary (Seal)

2. _____ _____

_____ _____
(Name, Title & Address) Corporate Guarantor (Seal)

FORM OF CONTRACT AGREEMENT

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

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

NOW this Agreement witnesseth as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents after incorporating addenda, if any except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Agreement, viz:

   (a) The Contract Agreement
   (b) The Letter of Acceptance
   (c) The completed Form of Bid
   (d) The Preamble to Conditions of Contract
   (e) The Particular Conditions of Contract
   (f) The General Conditions of Contract
   (g) The priced Schedule of Prices
   (h) The completed Schedules to Bid
   (i) The Specifications
   (j) The Drawings

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

4. The Employer hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

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

Signature of the Contactor	Signature of the Employer
_____	_____
(Seal)	(Seal)

Signed, Sealed and Delivered in the presence of:

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

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Employer]

Name of Guarantor (Bank) with address:_____
Name of Principal (Contractor) with address:_____
_____
Penal Sum of Security (express in words and figures)_____
_____
Letter of Acceptance No. _____Dated _____

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

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

_____ (Name of Project).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 30, Defects after Taking Over, of Conditions of Contract are fulfilled.

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

We, _____ (the Guarantor), waiving all objections and defences under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer's written declaration that the Principal has refused or failed to perform the obligations under the Contract which

payment will be effected by the Guarantor to Employer's designated Bank & Account Number.

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

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

_____
Guarantor (Bank)

Witness:

1. _____ Signature _____

_____ Name _____
Corporate Secretary (Seal)

Title _____

2. _____

_____ _____
Name, Title & Address Corporate Guarantor (Seal)

FORM OF BANK GUARANTEE/BOND FOR ADVANCE PAYMENT

Guarantee No._____
Executed on_____
Expiry date _____

[Letter by the Guarantor to the Employer]

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

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

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

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

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

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

This guarantee shall 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 (Bank)

Witness:

1. _____ Signature _____

_____ Name _____
Corporate Secretary (Seal)

Title _____

2. _____

_____ _____
Name, Title & Address Corporate Guarantor (Seal)

SPECIFICATIONS

(Technical Specifications)

PUNJAB INDUSTRIAL ESTATES DEVELOPMENT AND MANAGEMENT COMPANY

CONSTRUCTION OF PANELS ROOM AND SUPPLY INSTALLATION AND COMISSIONING OF H.T EQUIPMENT FOR 2 NO. 11KV ELECTRICAL CONNECTIONS (0.98MW EACH) OF STITCHING UNITS (PLOT NO. 09A TO 12A) AT QUAID-E-AZAM BUSINESS PARK, SHEIKHUPURA.

TECHNICAL SPECIFICATION

GENERAL SPECIFICATIONS FOR ELECTRICAL SYSTEMS

SCOPE OF WORK

The work under this Contract consists of supplying, fabrication, storage at site, manufacturing, installing, testing and commissioning of all materials and services etc., as specified herein, shown on the Drawings and given in the Schedule of Prices. Small items which are not expressly specified but which are necessary for completion of work shall be supplied by the Contractor without extra cost. The work shall be complete in every respect for satisfactory operation as per specifications and standards given hereinafter.

The Contractor shall co-ordinate with the Engineer at site with respect to other services for exact location and position of all electrical Equipments. The works related to the Electrical system that are included in the scope of Contract as shown on the Tender Drawings, Schedule of Prices and specifications. All the equipment & materials with allied accessories and their installation shall be new and described here-under, with other relevant provisions of Tender Document and WAPDA/NTDC/DISCO's latest Specifications/ Standards, Rules & Regulations shall broadly include but not limited to the following:

- Supply, fabrication, manufacturing, storage at site, installation, testing and commissioning of 11kV Ring Main Unit with allied accessories, in every respect for satisfactory operation, installation & associated civil works

- Supply, fabrication, manufacturing, storage at site, installation, testing and commissioning of 11kV Panels with allied accessories, in every respect for satisfactory operation, installation & associated civil works

- Supply, fabrication, manufacturing, storage at site, installation, testing and commissioning of distribution transformers (11/0.415kV) with allied accessories, in every respect for satisfactory operation, installation & associated civil works.

- Supply, fabrication, manufacturing, storage at site, installation, testing and commissioning of the MV 8.7/15 kV single/ multicore core Aluminum cable Al./XLPE/PVC/AWA/PVC cross linked polyethylene power cables as per WAPDA standard & associated civil works.

- Supply, fabrication, manufacturing, storage at site, installation, testing and commissioning of the Termination Kits, Straight joints and Earth Fault indicators associated Electrical & Civil works.

- Supply, installation, testing and commissioning of the cable earth fault indicators (EFI) & associated civil works.

- Supply, installation, testing and commissioning of earthing system and allied works & associated civil works.

DRAWINGS AND DATA TO BE FURNISHED BY THE CONTRACTOR

TECHNICAL DATA TO BE SUBMITTED

Technical data shall be submitted as per Technical Specifications for approval of 'The Engineer' Before manufacturing, of all Equipments.

APPROVAL OF DRAWINGS AND DATA

The Contractor shall provide detailed electrical drawings, electrification network, foundation details, etc., for all electrical and other systems etc., for the Engineer's review and approval. The manufacturing of electrical equipment shall be started only after the above-mentioned drawings and data are approved.

The time required for review and approval shall be considered included in the total time of completion of job. Three sets of drawings and data for each equipment & material shall be furnished by the Contractor for the Engineer's approval before commencement of fabrication and manufacturing.

a) **ENGINEERS DRAWINGS**: The location of the various items indicated on the tender construction drawings are presumed to be approximately correct, but it is understood however, that the small-scale drawings are necessarily based on the Catalogue information and as such are diagrammatic, and that such dimensions or locations as are shown, are subject to slight variation as the work is installed which may be necessary to accommodate local construction conditions. No major changes, however, will be made without the prior approval in writing.

b) **SHOP DRAWINGS**: The contractor shall submit to the Consultants/Engineer for review; three (3) copies of all shop and erection drawings along with the complete data of equipment and material applying to the contract. One copy will be returned to the contractor after review.

c) **AS-BUILT DRAWINGS**: upon completion of the work, the contractor shall furnish six sets of As Built drawings, specification and six sets of O&M manuals to be submitted to PIEDMC prior to TOC. Transparencies on tracing sepias with bound edges, prepared in a neat and accurate manner, showing the work in complete details as installed. Identification marks on the drawings shall correspond to

those marked on the installation. Supplementary drawings in transparencies will also be furnished of the entire installation, system and equipment for safety and operating controls in schematic form. These completion drawings shall then be scrutinized and finalized by the Consultants/Engineer shall also be supplied by the contractor.

d) **DRAWINGS TO BE KEPT ON SITE**: Two copies of the Drawings, furnished to the contractor as afore-said, shall be kept by the Contractor on the site and the same shall at all reasonable times be available for inspection and use by the Engineer and the engineer's Representative, and by any other person as authorized by the engineer.

PRESHIPMENT INSPECTION AND TESTING

GENERAL

All Equipments and materials covered in scope of this contract are subject to pre-shipment inspection & testing at the manufacturer's factory/works. The Contractor, in coordination with the manufacturers of relevant materials shall arrange for the pre-shipment inspection & testing by the Engineer at the manufacturer's factory/works. The Contractor shall make all necessary arrangements and cater for all expenses in this regard for the traveling, boarding and lodging of the Client & Consultant Engineer daily allowance @ Rs. 10,000 per day per person within Pakistan and US $ 300 per day per person outside Pakistan, for the pre-shipment inspection and to witness the tests at the manufacturer's factory/works. All FAT protocols will be as per WAPDA/DISCOs standards and specifications. However, any other special tests required by the Engineer will be performed by contractor under supervision of Consultant & Client

PRE-SHIPMENT FACTORY TESTS

All type and routine tests on all equipment, materials and switchgear shall be performed at the manufacturer's works in the presence of the Engineer or his Representative. Type tests may be waived off in case test certificates, certified by an approved standard laboratory of international repute, approved by the Engineer, are submitted. But merely producing the type test certificates shall not relieve the Contractor and the manufacturer to carry out the required tests. The Contractor shall obtain from the manufacturer and submit to the Engineer for approval, the complete details of tests to be performed describing the procedures, test observations and expected results.

The Contractor shall ensure availability of all tools, instruments, test Equipments, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all Equipments and materials including putting the same into operation.

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

The Contractor shall record all test values of the tests made by him on all equipment. Three (3) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc. The Contractor shall inform the Engineer about the place, date and time of test, of each equipment at least, two (2) weeks in advance. The witnessing of test by the Engineer or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment, and for furnishing the guarantees.

FIELD TESTS

GENERAL

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment and systems compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure test observations and expected results.

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

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

The Contractor shall record all test values of the tests made by him on all equipment. Three (03) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams, etc. The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship, or as any other obligations of contract.

Recommended Manufacturers.

1. **H.T Termination Kits & Joints**
   a) Raychem-Germany.
   b) Elastimold-Elastimold-Egypt.
   c) 3M-USA.
   d) Approved Equivalent (Make: EU/UK/USA).
2. **H.T Cables**
   a) Pakistan Cables.
   b) Newage Cables.
   c) FAST Cables.
3. **MDI TOU Energy Meter (0.2 Class and 0.5Class)**
   a) Approved as per Latest P202:2012.
4. **11kV Metering and Protection Panel**
   a) Approved as per lates P44:2018.
5. **3-Way RMU**
   a) Approved as Per Lates DDS 46:2009 WAPDA/LESCO/NTDC Approved.

NATIONAL TRANSMISSION & DESPATCH COMPANY LIMITED

NTDC SPECIFICATION P-44:2018

11kV METAL-CLAD SWITCHGEAR

SUBSTATION DESIGN NTDC

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PRINTING HISTORY

- First edition in August, 1968
- Second edition in December, 1979
- Third edition in 1985
- Fourth edition in 1987
- Fifth edition in April, 1996
- Sixth edition in Mar, 2018

NTDC SPECIFICATION P-44:2018
11kV METAL-CLAD SWITCHGEAR

0.0 FOREWORD

0.1 This specification has been prepared by Substation Design Department NTDC. This sixth edition cancels and replaces all the five editions published in 1968, 1979, 1985, 1987, 1996 and its amendments. This specification also supersedes P-115:77(11kV CT specification) & the technical requirement for capacitor control panel as given in specification P-165:89 & its amendments (if any).

0.2 This specification is intended for the procurement of material and does not include all the necessary provisions of a contract.

0.3 This specification is subject to revision as and when required by Substation Design Department NTDC. No other department is authorized to issue any change/amendment in it.

1.0 SCOPE

1.1 This specification is applicable for 11kV Metal-Clad Switchgear for indoor installation to be mounted on floor and opening in the bus-bar section so that bus bar compartment lies along all the units of a group of switchgear with bottom entry of power cables.

2.0 REFERENCE STANDARDS

2.1 The metal-clad switchgear and all auxiliary equipment which form an integral part of the switchgear shall be designed, manufactured and tested in accordance with the following International Electro-Technical Commission (IEC) Publications as amended to date:

IEC Publication 62271-1	Common specification
IEC Publication 62271-100	High voltage alternating current circuit breakers
IEC Publication 62271-102	High voltage AC disconnectors with earthing switches
IEC Publication 62271-103	High voltage switches for rated voltages above 1 kV and less than 52 kV
IEC Publication 62271-200	AC metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
IEC Publication 60255	Measuring relays and protection equipment
IEC Publication 61869-2	Current transformers
IEC Publication 61869-3	Voltage transformers
IEC Publication 60051	Direct acting indicating analogue electrical measuring instruments and their accessories
IEC Publication 60468	Method of measurement of resistivity of metallic materials
IEC Publication 60529	Degree of protection (IP Code)
NTDC Specification P-151:2008	Requirements for protection relays

2.2 In case the requirements laid down herein differ from those given in the above IEC Publications in any particular, the switchgear shall comply with the requirements indicated herein in regard to that item.

3.0 DEFINITIONS

For this purpose, the definitions of relevant IEC Standards shall apply. Some of them are recalled here for ease of reference.

3.1 Switchgear and Control-gear

General term covering switching devices and their combination with associated control, measuring, protective and regulating equipment.

3.2 Enclosure

Part of switchgear and controlgear providing a specified degree of protection of equipment against external influences and specified degree of protection against approach to or contact with live parts and contact with moving parts.

3.3 Compartment

Part of switchgear and controlgear enclosed except for openings necessary for interconnection, control or ventilation.

3.4 Partition

Part of switchgear and controlgear separating one compartment from other compartments.

3.5 Shutter

Part of switchgear and controlgear that can be moved from a position where it permits contacts of a removable part, or moving contact of a disconnector, to engage fixed contacts, to a position where it becomes a part of the enclosure or partition shielding the fixed contacts.

3.6 Main Circuit

All the conductive parts of metal-enclosed switchgear and controlgear included in a circuit which is intended to transmit electrical energy.

3.7 Auxiliary Circuit

All the conductive parts of metal-enclosed switchgear and controlgear included in a circuit (other than the main circuit) intended to control, measure, signal and regulate.

3.8 Circuit-Breaker Class E2

Circuit-breaker designed so as not to require maintenance of the interrupting parts of the main circuit during its expected operating life, and only minimal maintenance of its other parts (circuit-breaker with extended electrical endurance).

3.9 **Circuit-Breaker Class C2**

Circuit-breaker with very low probability of restrike during capacitive current breaking as demonstrated by specific type tests.

3.10 **Circuit-Breaker Class M2**

Frequently operated circuit-breaker for special service requirements and designed so as to require only limited maintenance as demonstrated by specific type tests (circuit-breaker with extended mechanical endurance, mechanically type tested for 10,000 operations).

3.11 **Circuit-Breaker Class S1**

Circuit breaker intended to be used in a cable system.

3.12 **No-Load Line-Charging Breaking Capacity**

Breaking capacity for which the specified conditions of use and behavior include the opening of an overhead line operating at no-load.

3.13 **No-Load Cable-Charging Breaking Capacity**

Breaking capacity for which the specified conditions of use and behavior include the opening of an insulated cable operating at no-load.

3.14 **Capacitor Bank Breaking Capacity**

Breaking capacity for which the specified conditions of use and behavior include the opening of a capacitor bank.

3.15 **Capacitor Bank Inrush Making Capacity**

Making capacity for which the specified conditions of use and behavior include the closing onto a capacitor bank.

3.16 **Out-of-Phase (making or breaking) Capacity**

Making or breaking capacity for which the specified conditions of use and behavior include the loss or the lack of synchronism between the parts of an electrical system on either side of the circuit-breaker.

3.17 **Opening Time**

a) For a circuit-breaker tripped by any form of auxiliary power, the opening time is the interval of time between the instant of energizing the opening release, the circuit-breaker being in the closed position, and the instant when the arcing contacts have separated in all poles;

b) For a self-tripping circuit-breaker, the opening time is the interval of time between the instant at which, the circuit-breaker being in the closed position, the current in the main

circuit reaches the operating value of the over-current release and the instant when the arcing contacts have separated in all poles.

3.18 **Arcing Time (multi pole switching device)**

Interval of time between the instant of the first initiation of an arc and the instant of final arc extinction in all poles.

3.19 **Break Time**

Interval of time between the beginning of the opening time of a mechanical switching device and the end of the arcing time.

3.20 **Closing Time**

Interval of time between energizing the closing circuit, the circuit-breaker being in the open position, and the instant when the contacts touch in all poles.

3.21 **Make Time**

Interval of time between energizing the closing circuit, the circuit-breaker being in the open position, and the instant when the current begins to flow in the first pole.

3.22 **Pre-Arcing Time**

Interval of time between the initiation of current flow in the first pole during a closing operation and the instant when the contacts touch in all poles for three-phase conditions and the instant when the contacts touch in the arcing pole for single-phase conditions.

3.23 **Open-Close Time (during auto-reclosing)**

Interval of time between the instant when the arcing contacts have separated in all poles and the instant when the contacts touch in the first pole during a reclosing cycle.

3.24 **Dead Time (during auto-reclosing)**

Interval of time between final arc extinction in all poles in the opening operation and the first re-establishment of current in any pole in the subsequent closing operation.

3.25 **Re-closing Time**

Interval of time between the beginning of the opening time and the instant when the contacts touch in all poles during a reclosing cycle.

3.26 **Re-Make Time (during reclosing)**

Interval of time between the beginning of the opening time and the first re-establishment of current in any pole in the subsequent closing operation.

3.27 **Close-Open Time**

Interval of time between the instant when the contacts touch in the first pole during a closing operation and the instant when the arcing contacts have separated in all poles during the subsequent opening operation.

3.28 **Make-Break Time**

Interval of time between the initiation of current flow in the first pole during a closing operation and the end of the arcing time during the subsequent opening operation.

3.29 **First-Pole-to-Clear Factor (in a three-phase system)**

When interrupting any symmetrical three-phase current the first-pole-to-clear factor is the ratio of the power frequency voltage across the interrupting pole before current interruption in the other poles, to the power frequency voltage occurring across the pole or the poles after interruption in all three poles.

3.30 **Out-of-Phase Conditions**

Abnormal circuit conditions of loss or lack of synchronism between the parts of an electrical system on either side of a circuit-breaker in which, at the instant of operation of the circuit breaker, the phase angle between rotating vectors, representing the generated voltages on either side, exceeds the normal value and may be as much as 180° (phase opposition).

3.31 **Normal Current**

Current which the main circuit of a circuit-breaker is capable of carrying continuously under specified conditions of use and behavior.

3.32 **Rated Short-time Withstand Current (Ik)**

The r.m.s value of the current which the switchgear and controlgear can carry in the closed position during a specified short time under prescribed conditions of use and behavior. (Ik = Isc)

3.33 **Rated Duration of Short Circuit**

The interval of time for which switchgear and controlgear can carry, in the closed position, a current equal to its rated short-time withstand current.

3.34 **Rated Peak Withstand Current (Ip)**

The peak current associated with the first major loop of the rated short-time withstand current which switchgear and controlgear can carry in the closed position under prescribed conditions of use and behavior.

3.35 **Rated Short-Circuit Breaking Current (Isc)**

The rated short circuit breaking current is the highest circuit current which the circuit breaker shall be capable of breaking under prescribed conditions of use and behavior.

3.36 **Rated Cable Charging Breaking Current**

The rated cable charging breaking current is the maximum cable charging current which the circuit breaker shall be capable of breaking at its rated voltage under prescribed conditions of use and behavior.

4.0 SERVICE CONDITIONS

4.1 Atmospheric Conditions

It may be assumed that the air is not normally heavily polluted by dust, smoke, aggressive gases, vapors or salt spray. However, at certain times of the year, severe dust storms may be experienced and certain areas are subjected to heavily polluted atmosphere. For this purpose, special lacquer coating on bus bar support insulators shall be applied to protect against the effects of humidity and other pollutions.

4.2 Ambient Temperature

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

4.3 Relative Humidity

The relative humidity may range up to 100 %. The maximum values of the ambient temperature and humidity, however, do not occur simultaneously. During the monsoons, high humidity may persist for many days at a time, with temperature ranging from 30 °C to 40 °C.

4.4 Altitude

Installations will be up to 1000 meter above sea level.

4.5 Supply System

The switchgear shall be suitable for installation in 11kV 3-phase AC supply system with the following characteristics:

Nominal system voltage	11 kV
Rated voltage	12 kV
Frequency	50 Hz

5.0 CONSTRUCTIONAL REQUIREMENTS

5.1 General

5.1.1 The switchgear panel shall be equipped with a draw-out type circuit breaker and all associated equipment mentioned in this specification for indoor use to be mounted on the floor and shall be

supplied in the form of a single switchgear panel for straight forward extension of existing installations on either side. The frame and supporting parts are designed as a compound construction of welded/bolted/riveting sections.

5.1.2 The metal-clad panel shall consist of cable compartment situated at rear bottom, CB compartment situated at front, bus-bar compartment situated at rear top, and relay & meter compartment situated at front top of the panel. All live parts such as circuit breakers, busbars, current and voltage transformers etc. shall be enclosed within grounded metal compartments separated by grounded metal barriers. The bus-bar and cable compartments shall be separated from the CB compartment through automatic shutters to prevent exposure of live parts when the CB is in disconnected/test position. Necessary means shall be provided to separate CB & cable compartments when CB is in connected positions.

5.1.3 All secondary wiring and instruments, meters, relays etc. shall be isolated from ground metal barriers and from all primary circuit elements with the exception of short lengths of wires at instrument transformer terminals.

5.1.4 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. Fire retardant pipe/shrouds shall be provided for covering the bus bar joints & connections to the adjacent panels on both sides. Fiber glass sheet having minimum thickness of 3mm for covering of bus bar chamber on both sides of each panel shall also be installed.

5.2 **Standardization of switchgear Panels**

5.2.1 To accomplish the interchangeability requirement of switchgear panels manufactured by different manufactures, certain dimensions of the switchgear panel, bus-bars & their joints, CT's and PT's etc. have been standardized as per drawing Nos. PDW/DF-423, PDW/DF-447, PDW/TS-1630, PDW/DF-297, PDW/TS-2010 and PDW/TS-4932.

5.2.2 The mounting arrangement of energy meter shall be provided in such a way that various types of energy meters can be fixed on the same arrangement.

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

5.3 **Standard Types of Panels**

The switchgear Panels shall be of the following types:

a) Incoming panel for connecting the 11kV switchgear to the power transformer.

b) Outgoing panel for connecting supply to 11kV feeder.

c) Bus-coupler panel for connecting two Incoming panels where two power transformers are installed and for gird station auxiliary supply.

d) Industrial panel for giving 11kV supply to individual consumer.

e) Ring main panel for giving 11kV supply to individual consumers fed from two different feeders.

f) Consumer panel for giving connection to an individual consumer from the grid stations through an express or dedicated 11kV feeder.

g) Capacitor bank control panel for the automatic switching of the capacitor banks

5.4 **Interchangeability**

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

5.5 **Short-circuit Strength**

Each switchgear panel shall be designed to carry and withstand following thermal and mechanical stresses:

a) Rated short-time withstand current for main and earthing circuit (1s): 25kA

b) Rated peak withstand current for main and earthing circuits: 63kA

5.6 **Protection and Metering**

5.6.1 **Over-current Protection**

All switchgear panels shall have over-current & earth fault protection. For incoming, outgoing & consumer panels, the over-current relays shall operate on 110 VDC. For industrial & ring main panels, the relay shall be arranged to operate on AC or any alternate arrangement in case of operation of relay on DC. Arrangement will be approved by the office of Chief Engineer (SS) NTDC.

5.6.2 **Differential Protection**

Incoming panels shall be provided with three additional current transformers for differential protection. The differential protection zone of power transformers is required to trip the 11kV incoming circuit breakers.

5.6.3 **DC Supply and Trip Indications**

Supervision relay(s) shall be provided for continuously monitoring the healthy conditions of breaker trip circuit and presence of DC supply on all applicable panels. The presence of healthy trip circuits shall be indicated by the continuous glow of a lamp.

5.6.4 **Hooter**

5.6.4.1 One hooter with its acknowledge and canceling arrangement shall be installed in the incoming panel to indicate failure of DC mains supply, DC supply failure to any panel, failure of P.T. MCB supply and failure of healthy trip circuit and tripping of any breaker. In all switchgear panels NC contact of each MCB shall be used for alarm purpose, completely wired. Tripping of any one MCB shall initiate an alarm signal.

5.6.4.2 One hooter and its acknowledgement and canceling arrangement shall also be installed in the capacitor bank control panel.

5.6.5 **Metering**

5.6.5.1 Arrangements for metering shall be provided as shown in drawing No. PDW/TE-580 & 581. The voltage coils of all energy meters, instruments & relays of the outgoing & capacitor panels shall be connected to the voltage transformer of the corresponding bus section installed in incoming panels.

5.6.5.2 For switchboards with bus coupler, the voltage transformer of each bus section shall be operated independently. However, when the corresponding incoming feeder is out of service and the bus coupler is closed, the voltage transformer in service shall feed all the panels. Therefore, P.T. selection scheme shall be developed in each relevant panel to fulfill the requirement.

5.6.5.3 In case of industrial, consumer and ring main panels, independent voltage transformers shall be provided for metering of energy. Moreover, the metering equipment in these panels shall be housed in separate, lockable and sealable compartment.

5.7 **Signaling Lamps**

5.7.1 The indicating lamps shall be of 22 mm panel mount LED type with life of minimum 35,000 Hours and shall not be greater than 4 W at 150 V. Signaling lamps shall be provided with name plate.

5.7.2 For each panel, two signaling lamps "RED" and "GREEN" shall be provided to indicate "ON" and "OFF" positions of the circuit breaker respectively.

5.7.3 Yellow signaling lamp indicating DC trip circuit healthiness shall be provided.

5.7.4 Blue signaling lamp indicating "OFF" position of P.T. supply shall be provided.

5.7.5 Purple signaling lamp indicating AC alarm supply failure shall be provided.

5.7.6 White signaling lamp/signaling relay indicating fault indication shall be provided.

5.8 **Surge Arrestors**

Surge arrestors having rated voltage 12 kV and nominal discharge current of 10 kA shall be installed in the outgoing, capacitor control & consumer panels near to the cable termination. The surge arrestors shall conform to NTDC Specification P-181:2012 amended to date.

5.9 **Insulation and Clearances**

5.9.1 Switchgear panels shall be designed for the following insulation level:

a) Lightning impulse withstand voltage: 95 kV

b) Power frequency withstand voltage for one minute.: 36 kV

5.9.2 The minimum phase to phase and phase to ground clearance in air shall be 160 mm. In case of clearances less than the above specified value, insulation barrier plates of fire retardant fiber glass having thickness 3.0 mm (min.) shall be provided. The insulation barrier between the poles of breaker shall be of manufacturer's recommended material.

5.9.3 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. The insulating materials for barriers, covers and sleeves etc. shall essentially have non-hygroscopic, non-corrosive, non-tracking and non-inflammable properties such as reinforced fiber glass, epoxy resin etc., specially made to suit the intended applications with respect to mechanical, electrical and thermal requirements. Complete details regarding mechanical, electrical and thermal characteristics of the insulating material along with proposed locations for installation shall be supplied for approval.

5.9.4 At locations such as breaker terminals or interconnections where it is not possible to meet above clearances, smaller clearances with insulation will be permitted subject to approval and withstanding insulation tests.

5.10 **Earthing**

5.10.1 All metal parts of a switchgear panel shall be effectively bonded together to form a continuous earthing. Hinged doors shall be connected to the panel body by means of flexible copper earthing straps having minimum 30 mm^2 cross-section.

5.10.2 Each panel shall be provided with a copper earth strip of cross section 25×5 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 either side as required to form a common earth bus as shown in drawing No. PDW/TS-2010. Earthing terminals for taking 7 to 15 mm dia. copper wire for connection to the substation earthing system shall also be provided.

5.10.3 The earthing connections of the auxiliary equipment e.g. CTs & PTs etc. to the main earth busbar shall be made by means of 16 mm^2 solid copper strip or flexible insulated copper cable. All cable glands/brackets shall be connected to the main earth busbar by means of 25×5 mm solid copper strip.

5.10.4 The withdrawable metallic parts of the switchgear shall be provided with a separate earthing conductor within the switchgear unit frame fixed along the switchgear in such a manner that permanent direct earth connections are established which shall be capable of carrying short circuit currents. The circuit breaker frame 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. On insertion, the normally earthed metallic parts of CB shall be connected to earth prior to the making of the male/fixed and female/movable contacts.

5.10.5 The bus coupler panels shall also be provided with an external earthing point.

5.10.6 Two independent earthing points with earthing lugs shall be provided in industrial and ring main panels.

5.11 **Circuit Connections**

5.11.1 **Incoming Panel**

Each incoming panel shall have provision of incoming circuit by means of underground cables. Space shall be provided for the cable connections with dry termination of 5 Nos. per phase single core 500 mm² (1000 MCM) cross-linked polyethylene (XLPE) aluminium/copper cables having outer diameter of 50 mm approx.

5.11.2 **Outgoing and Consumer Panels**

Each outgoing and consumer panel shall have sufficient space and provisions for the dry termination of three (one per phase) single core 500mm² (1000 MCM) cross-linked polyethylene (XLPE) aluminium/ copper cables having outer diameter of 50mm approx.

5.11.3 **Capacitor Bank Control Panel**

Each capacitor bank control panel shall have sufficient space and provisions for the dry termination of three single core 240mm² (500 MCM) cross-linked polyethylene (XLPE) aluminium/copper cables per phase having outer diameter of 35mm approx.

5.11.4 **Others**

Each bus coupler, industrial and ring main panel shall have sufficient space for provision of dry termination for the following cables:

a) One 3-core, 120mm² cross-linked polyethylene (XLPE) aluminium/copper cable for bus coupler panel having outer diameter of 60 mm approx.

b) One 3-core, 35mm² to 120mm² cross-linked polyethylene (XLPE) aluminium/copper cable for ring main and industrial panels having outer diameter 60 to 75 mm approx.

5.11.5 The cable termination pads shall be supported on 12kV post insulators. The manufacturer shall provide terminals with high tensile steel bolts, nuts and washers for cable connections in accordance with drawing No. PDW/DF-444.

5.12 **Special Tools and Accessories**

5.12.1 A set of special tools and accessories shall be supplied which always include, but not be limited to the following:

a) Operating attachment/handle for the withdrawal and insertion of the circuit breaker trolley (one per two panels).

b) Spring charging handle for manual charging of the spring (one per two panels).

c) Instrument compartment door locking key (one per panel).

d) Bus bar coupling pieces made of copper as per drawing No. PDW/TS-2010 with nuts, bolts and washers for each switchgear panels for interconnection throughout the length of adjacent panels forming a common bus duct except for industrial/ring main unit (Nine per panel).

e) Two interconnection pieces for connecting earth bus bars of adjacent panels as per drawing No. PDW/TS-2010 for each switchgear panels except industrial/ring main unit.

f) Four grouting bolts for mounting the switchgear panel on the floor.

g) Operation and maintenance catalogues for circuit breaker, relays, energy meter and complete set of schematic diagrams (one set per five panels).

h) End box complete with fixing arrangement (Two per five panels).

i) One earthing kit for each incoming, industrial and ring main panels for safety while carrying out maintenance.

j) Guide/Extension plate of 600mm×900×2.5mm with guide rails to facilitate the truck movement on the floor in case of truck type circuit breaker (one per panel).

k) Trolley to facilitate insertion or removal in case of cassette type circuit breaker (Two per five panels/ as per requirement of purchaser)

l) Nine fire retardant pipes/shrouds for covering busbar joints & interconnections as per clause 11.3 of this specification.

m) Laminated wiring diagram of VCB & Panel with each panel.

5.12.2 The tools/accessories listed from a) to f) shall be housed in a tool box for the safe storage.

5.12.3 The earthing kit is equipped with three flexible insulated short-circuiting copper cables for each phase having length of at-least one meter joined together in a junction box and one insulated earth cable having length of at-least 1.5m for connection to system earthing. Threaded copper ball head cap clamps suitable for tightening the ball pin having diameter above 20 mm by means of insulating operating stick from a distance of at least one meter shall be crimped on each short-circuiting cable while earth clamp shall be crimped with the earth cable. The size of flexible insulated copper cables shall be 95 mm². The earthing kit shall be designed to carry and withstand rated short-time withstand current of 25 kA for 1 sec. The insulated stick shall withstand the power frequency voltage of 300kV per meter for 5 minutes. The complete earthing kit shall be packed in a carrying bag for storage and transportation.

6.0 COMPONENTS OF SWITCHGEAR PANELS

The components of all types of switchgear panels are listed in Table-I. Each switchgear panel shall be supplied with Cable termination pads, signaling lamps and Push buttons for electrical ON & OFF as per their requirement.

TABLE – I: Components of Metal-Clad Switchgear Panels

Sr. No.	Item Description	Incoming Panel	Outgoing Panel	Bus-Coupler Panel	Capacitor Control Panel	Consumer Panel	Industrial Panel	Ring Main Panel
1	Circuit breaker	1	1	1	1	1	1	1
2	Load break switch	-	-	2	-	-	-	2
3	Earthing switch	-	1(i)	-	1(i)	1(i)	-	-
4	Single phase, 2-core CT for over-current protection and metering	3	3	-	3	-	-	-
5	Single phase, 1-core CT for over-current protection	-	-	-	-	3	3	3
6	Single phase, 1-core CT for metering	-	-	-	-	3	3	3
7	Single phase, 1-core CT for differential protection	3	-	-	-	-	-	-
8	Single phase voltage transformer	3	-	-	-	3	3	3
9	Surge arrestors	-	3	-	3	3	-	-
10	Over-current and Earth-fault relay	1(ii)	1(ii)	-	1(iii)	1(ii)	1(iv)	1(iv)
11	Two step capacitor unbalance detection Relay	-	-	-	1(iii)	-	-	-
12	Under voltage/over voltage relay	-	-	-	1	-	-	-
13	DC trip circuit supervision relay (TCS)	2	2	-	2	2	1(v)	1(v)
14	Trip & lockout relay	-	-	-	1	-	-	-
15	Energy meter	1	1	-	-	1	1	1
16	Ammeter	3	3	-	1	1	3	3
17	Voltmeter 0 -15kV with 7 position selector switch	1	-	-	1	1	1	1
18	Power factor meter	1	1	-	1	1	1	1
19	Hooter and its acknowledgement	1	-	-	1	-	-	-
20	Power quality analyzer	1(i)	-	-	-	1(i)	-	-

i) If required by purchaser/end user.
ii) Three Phase four element Over Current & Earth Fault Relay shall be used as per clause 12.5.

iii) Three Phase five elements Over Current & Earth Fault Relay shall be used with built-in two step capacitor unbalance detection protection in Capacitor Control Panel as per clause 12.5.

iv) For industrial and ring main panels, the relays shall be arranged to operate on AC or any alternate arrangement in case of operation on DC with the approval of o/o Chief Engineer (SS) NTDC.

v) For industrial and ring main panels, DC Supervision relay shall be provided in case of operation on DC.

7.0 CIRCUIT BREAKER

7.1 General Requirements

7.1.1 The circuit breaker shall be draw-out vacuum type suitable for indoor installation with unique traceable tracking identification. The circuit breaker shall be triple pole, fixed with cast resin post insulators, and coupled electrically as well as mechanically on a common base frame so as to operate simultaneously. All drive parts, auxiliary & control switches, charging motor, over-current & under voltage releases, anti-pumping system, anti-slam system, lockout relay for interlocking, closing & trip coils, spring charged indicator, counter, etc. shall be placed in a closed cabinet. The complete CB shall be mounted on the withdrawable truck or on trolley with carriage arrangement to facilitate its insertion/removal.

7.1.2 The CB shall be provided with an energy storing device which shall be charged both manually by hand crank as well as electrically by an electric motor. In a closed position, the circuit breaker can be brought for mechanical "ON" & "OFF" from front of CB and electrically "ON" & "OFF" by means of push buttons in the instrument compartment while showing position indication.

7.1.3 The circuit breaker shall be vertically/horizontally isolated, suitable for automatic tripping, re-closing, shall have interlocking devices, arc control devices, disconnecting devices, automatic safety shutters with locking facility and all necessary accessories to make a complete operating unit. The circuit breaker shall be suitable for single shot, 3-pole rapid auto re-closing.

7.1.4 The circuit breaker shall be capable of making and breaking all short circuit currents, symmetrical & asymmetrical, up to and including the rated short circuit breaking currents. The circuit breaker shall also be capable of switching covered by transients over & under voltage and over-currents in the system i.e. switching the no load currents of transformers, switching of shunt capacitor banks, switching under condition of single/double earth faults, switching under condition of phase opposition (out of phase condition) and the switching the charging current of cables. To achieve these requirements, necessary devices shall be equipped in the operating mechanism.

7.1.5 In case the CB is mounted on truck, the wheels of truck on the operator side shall have rotating facilities with locking arrangement in ON position to prevent moving of circuit breaker and shall have provision of earth to withstand the short circuit stresses. In case of carriage/cassette arrangement, trolley shall be used only for removal of CB outside the switchgear panel or vice versa.

7.1.6 The circuit breaker shall incorporate anti-pumping & anti-slam feature which shall be the integral part of circuit breaker to avoid continuously energizing the circuit breaker closing coil, once the circuit breaker has already closed. Moreover, circuit breaker shall be trip free.

7.1.7 The mechanical strength and physical characteristics of the insulation structure shall be such that it can withstand the shocks of circuit breaker operations within the rated capacities as well as reasonable strains of connecting conductors under the specified service conditions.

7.1.8 Circuit breaker shall be so constructed that the interval between instants the contacts of the individual poles touch or separate shall not exceed 10ms during closing or opening operation.

7.1.9 It shall be possible to make independent adjustments to each unit of circuit breaker where circuit breaker comprises three independent units.

7.1.10 Where single rods & tubes are used for raising or lowering the moving contacts of the circuit breaker they shall be securely pinned at each end to prevent rotation or displacement of the contacts. Tubes shall be plugged securely where contacts or other parts are fixed to the tube.

7.2 Vacuum Interrupter of VCB

7.2.1 The vacuum interrupter which is a core component of VCB requires reliable operation such that even after repeated fault interruptions, the contact resistance is not impaired and remains constant due to contact pressure throughout its service life without maintenance. The arc interrupting mechanism shall be designed with ample mechanical and electrical factors of safety in all its parts. The X-radiation level during operation shall be kept within permissible safety limits according to international standards.

7.2.2 The vacuum interrupter tube shall have excellent vacuum tightness and mechanical characteristics. A permanent mark shall be provided on the lower interrupter support to check the contact wear/end of service life of vacuum interrupter (sticker is not acceptable).

7.3 Interlocks

7.3.1 At least the following interlocks shall be provided in the operating mechanism of circuit breaker to ensure safe operation in the correct sequence under all service conditions:

a) The withdrawal or engagement of a circuit breaker shall be prevented unless it is in the open position.
b) It shall be impossible to move the circuit breaker in service position unless the low voltage plug is inserted to the auxiliary circuit.
c) It shall be impossible to move the circuit breaker from service while it is in closed position.
d) The closing operation of the circuit breaker shall be prevented when the circuit breaker is already in closed position or under opening operation phase.
e) The closing of VCB of incoming circuit breaker shall be blocked in case of PT MCB Trip or PT supply failure.
f) VCB of incoming circuit breaker shall be tripped in case of PT MCB trip or PT supply failure in order to block Energy Metering. Alarm & annunciation signal shall also be generated in case of PT MCB Trip or PT supply failure.
g) Complete withdrawal of circuit breaker shall not be possible unless auxiliary circuit is disconnected

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

7.3.2 For bus-coupler panel, electrical interlocking shall be such as that the CB shall not close if the circuit breakers of incoming panels on both sides of bus-coupler panel are in the closed position.

7.3.3 In addition, the manufacturer shall provide sufficient number of interlocks to provide full safety for the operator when parts of the circuit breaker or its mechanism become malfunctioning during the operation of the switchgear.

7.4 **Operating Device Movement**

The direction of motion of operating devices and handles wherever possible, shall be in accordance with the following.

a) Rotary handles shall be moved clockwise for switching ON and counter clockwise for switching OFF.

b) 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 shall move horizontally and away from the operator for a closing operation and towards the operator for an opening operation.

c) For push or pull buttons which are located one above the other, the upper button shall 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 the left-hand button shall be the OFF button. The ON button shall be colored red and the OFF button shall be colored green.

7.5 **Characteristics and Ratings**

The circuit breakers shall have the following characteristics and ratings:

a)	Nominal voltage	11kV
b)	Rated voltage	12kV
c)	Normal current at reference ambient temp. of 50 °C	
	i) Incoming & Bus-coupler panels	2500 A
	ii) Other switchgear panels	630 A
d)	Rated Frequency	50 Hz
e)	Rated auxiliary circuit DC voltage	110 V
f)	Rated Short circuit breaking current	25 kA
g)	Rated Peak withstand current	63 kA
h)	Rated Short circuit making current	63 kA
i)	Duration of short circuit	1 sec
j)	First pole to clear factor	1.5

k)	Rated TRV (Peak) for terminal faults		20.6 kV
l)	Rated TRV (Peak) for Out of Phase		30.6 kV
m)	One-minute AC withstand voltage		36 kV
n)	Lightning Impulse withstand voltage		95 kV
o)	Single capacitor bank breaking current		As per IEC
p)	Rate of rise of recovery voltage (RRRV)		As per IEC
q)	Operating sequence		
	i)	Outgoing, consumer and capacitor bank control panels (with fast auto-reclosing)	O-0.3sec-CO-3min-CO
	ii)	Others (without fast auto-reclosing)	O-3min-CO-3min-CO
r)	Break time		As per IEC
s)	Dead time		As per IEC
t)	Opening time		As per IEC
u)	Closing time		As per IEC
v)	Spring charging time		≤15sec
w)	Close-Open time		As per IEC
x)	Circuit Breaker Class		
	i)	w.r.t Mechanical Endurance	M2
	ii)	w.r.t Electrical Endurance	E2
	iii)	w.r.t. Capacitive Current Breaking	C2
	iv)	w.r.t Connection to Cables	S1

7.6 **Isolation of Breaker**

7.6.1 A set of six female silver-plated copper clip/flat/tulip (preferably on higher rating) type contacts for 2500A & 630A CBs shall be provided for separating the CB from silver plated male contacts to be fixed in cast resin spouts to eliminate possibility of misalignment and to ensure separation of compartments. Further for cassette type VCB complete VCB including cradle of high grade shall be provided from original manufacturer as a part of circuit breaker (no alternate will be acceptable). In the isolation/ withdrawal position of CB from live part, the shutter shall be closed automatically.

7.6.2 Silver plated plug contacts shall be provided between separable units to complete the secondary circuits. They shall be of the pressure loaded self-aligning type. In case the connection of auxiliary circuit wiring plug with circuit breaker socket is to be made manually the plug shall be held tightly in the socket with spring loaded clips. Wiring of auxiliary circuit to circuit breaker shall be routed through flexible steel pipe or high quality flexible plastic pipe.

7.7 **Operating Mechanism**

7.7.1 The operating mechanism shall be spring charged electrically as well as manually with push buttons for closing and opening of the circuit breaker. The closing springs shall be charged with 240 V AC

variation range of +10% and -15%. The closing springs, if charged, should not be capable of release while the circuit breaker is closed.

7.7.2 The energy stored in motor compressed spring shall be sufficient for an open-close-open operation at rated short circuit current. The motor shall not require more than 15s to recharge the closing springs after a C-O or O-C operation. If the closing mechanism is not fully recharged, the mechanism shall be locked out and an alarm initiated.

7.7.3 The mechanism of circuit breaker shall be so arranged that emergency manual spring charging by using hand crank and release of the springs is possible without electrical operation. The circuit breaker shall be provided with the indicator to show the charged/discharged state of spring.

7.7.4 The rated control and auxiliary supply voltages shall be 110 VDC. Operating mechanism of the breaker and all other associated accessories/components shall operate satisfactorily within the range of voltage given below:

11kV Panels	**Closing Circuits (Volts)**		**Tripping Circuits (Volts)**	
Incoming, outgoing, consumer & capacitor protection panels	110VDC (93V-121V)	-	110VDC (77V-121V)	
Industrial & Ring main Panels	110VDC (93V-121V)	230VAC (150V-250V)	110VDC (77V-121V)	230VAC (150V-250V)

7.7.5 Trip coils to be provided in each type of panel shall be as under:

Incoming Panel	Two DC trip coils.
Outgoing, Consumer, Bus-Coupler and capacitor bank control panels	Two DC trip coils.
Industrial & ring main panels	Three (03) AC trip coils or alternatively DC shunt trip coil with capacitor trip unit arrangement and will be approved by O/o C.E (S&S) NTDC.

7.7.6 The VA capacity of trip coils shall be such that they are capable to perform mechanical endurance test without being over heated or change in characteristics.

7.7.7 A 5-digit operation counter without resetting shall be provided to record the number of opening operations of the circuit breaker. It shall be visible and readable from outside the switchgear.

7.8 **Circuit Breaker Auxiliary Switch and Control Contacts**

7.8.1 The connection to the circuit breaker is established by means of multiple pin plug and flexible cable. The auxiliary switch shall have adequate number of contacts so that, in addition to contacts actually used in circuit connections, at least four NO and four NC spare contacts shall be provided for future use. The PT supply of incoming panel shall be routed through auxiliary contacts of circuit breaker.

7.8.2 Auxiliary contacts shall be suitable for the number of electrical and mechanical operating cycles specified for the switching device. The operating characteristics of auxiliary contacts shall comply with the requirements of relevant IEC standard.

7.9 Rating Plate

Each circuit breaker and its operating devices shall be provided with a rating plate marked with the following data/information in an indelible manner.

a) CB Manufacturer's name with country of origin.
b) Circuit breaker type/designation.
c) Serial No. of circuit breaker along with date of manufacturing of Breaker.
d) Interrupter manufacturer's name with country of origin.
e) Type designation of interrupter.
f) Rated voltage, kV
g) Rated frequency, Hz
h) Rated normal current, A
i) Rated insulation level
j) Lightning impulse withstand voltage, kV
k) One-minute power frequency withstand voltage, kV
l) Rated short-circuit breaking current, kA
m) Rated duration of short-circuit
n) Rated short-circuit making current, kA
o) Single capacitor bank breaking current, A
p) Rated operating sequence
q) Rated supply voltage and frequency of closing and opening devices
r) Rated supply voltage and frequency of control & auxiliary circuits
s) Weight

7.10 Tests on Circuit Breaker

7.10.1 The tests shall be made in accordance with the procedure mentioned in IEC Publication 62271-100 and as specified herein.

7.10.2 Routine Tests

The following routine tests shall be made on circuit breaker.

a) Measurement of the resistance of interrupter & main circuit.
b) Verification of components used in operating mechanism, their conformance to that of type tested sample.
c) Checking of interlocking arrangement and other requirements as per clause 7.4.
d) One Minute AC Voltage Withstand test (36 kV)
e) Mechanical operation tests.
f) Tests on auxiliary & control devices (2kV for 1 min)

7.10.3 **Type Tests**

7.10.3.1.1 Duly certified and complete type test reports for tests as specified herein carried out at an STL approved lab on circuit breaker having same design, voltage ratings shall be acceptable in lieu of actual tests. The validity of the type tests reports shall be as per type test policy of NTDC.

7.10.3.1.2 In case of non-production of the requisite type test reports or if the type test reports are otherwise not acceptable to the Design NTDC following type tests shall be performed on circuit breaker at STL approved lab or any independent lab approved by Design NTDC in the presence of two representative of Design NTDC at the cost & arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the inspector to prove compliance with the requirement as listed in this specification.

Table-II

No.	Description of Tests	Current Rating
a)	Dielectric tests	630A & 2500A
b)	Measurement of resistance of main circuit and interrupter	630A & 2500A
c)	Temperature rise test	630A & 2500A
d)	Short time withstand and peak withstand current tests	630A & 2500A
e)	Extended mechanical endurance test at ambient air Temperature	630A & 2500A
f)	Short circuit current making and breaking tests	630A & 2500A
g)	Capacitor bank breaking & Capacitive current switching test	630A & 2500A
h)	Short circuit life test	630A
i)	Electrical endurance test	2500A
j)	Small inductive current breaking test	630A & 2500A
k)	Measurement of contact wear	630A & 2500A

7.10.3.2 **Short Circuit Life Test**

The circuit breaker shall be subjected to short circuit life test. The tests shall be carried out according to the test duties as indicated in Table-III based on IEC 62271-100 except as modified herein.

a) The short circuit breaking currents and the respective number of operations for each test duty as mentioned in Table-III shall be applied in one stretch. The time interval between operations shall not exceed 3 minutes. In case, the time interval between any operations is more than 3 minutes, the complete respective short circuit breaking current test series/operations shall be repeated except if allowed in IEC standard.

b) Single phase short circuit breaking test has been included to show that operation of the circuit breaker is not adversely affected by unbalance forces produced. This test duty will consist of close-open operations at rated pole i.e. Red, Yellow or Blue phase and applied in one stretch in each pole.

c) The transient recovery voltage shall meet the requirement with the specified values as for three phase tests by dividing voltages by first pole to clear factor 1.5, time co-ordinate remaining unchanged. The applied voltage shall not be less than phase to neutral value i.e. $12/\sqrt{3}$ kV.

d) Small inductive current breaking test shall be carried out during electrical life test to determine significant variation in chopping level of VCB if any. These shall be done at beginning and at the end of life cycle test.

e) The vacuum interrupter may be replaced with new ones after conducting small inductive current breaking test at beginning and before start of life cycle test series, if so desired by manufacturer/supplier. Small inductive current breaking test shall not be carried out separately if already carried out as part of short circuit life test.

f) The short circuit life test shall be preceded and followed by a temperature rise test and no-load operation test.

Conditions after Life Test Series

The circuit breaker shall be deemed to have passed the life test provided:

a) The characteristics of no load closing and opening test made before and after completion of the test series shall show no significant change.

b) The circuit breaker shall be capable of closing and opening at its rated normal current at the rated voltage although its short circuit making and breaking performance may be impaired. The main contacts shall be capable of carrying out rated normal current of the circuit breaker continuously without exceeding temperature rise limits specified in IEC62271-100 and withstanding the voltage specified under dielectric tests.

c) There shall be no mechanical or electrical insulation failure during the test series so as to impair the performance of the circuit breaker.

d) There shall be no indication of significant leakage current to the circuit breaker earth structure.

e) Re-strike during interruption is permissible so long as CB interrupt the short circuit current successfully. Over voltages produced during the life test shall be measured and shall not exceed the value specified in IEC 62271-100.

f) The change in average chopping current values measured at beginning and end of the life test shall not exceed more than 30%.

Table – III

Test duty	Short circuit breaking current	No. of operations
1	0.8 kA	CO: 30
	1.25 kA	CO: 40
	2.0 kA	CO: 50
2	3.1 kA	CO: 100
	5.0 kA	CO: 100
	8.0 kA	CO: 60
3	12.5 kA	CO: 60
	16.0 kA	CO: 55
4	25 kA (Symmetrical)	CO: 25
5	25 kA (Asymmetrical)	O: 5
Single Phase	25 kA	CO operations per each phase: 20

7.10.3.3 **Small Inductive Current Breaking Test**

These tests shall be carried out to ascertain:

1) the true chopping level of the vacuum circuit breaker
2) the over voltage levels for the two types of chopping (i.e. true and virtual)

The maximum switching over-voltage resulting in each condition shall be recorded and, in case this value exceeds 27 kV peak, suitable surge arresters as per clause 5.8 complying with NTDC Specification P-181:2012 (amended to date) shall be installed at appropriate place inside the relevant switchgear panels.

a) Switching of magnetizing current of an unloaded oil immersed three phase power transformer rate 11/33 kV, 4MVA connected to the circuit breaker via 30m long single core 500MCM, XLPE insulated aluminum cable.

b) Switching of 2 Nos. oil immersed, three phase distribution transformers rated 11/0.4kV, 1000KVA at (a) no load and (b) while supplying inductive loads of 10A (P.F=0.3), and 100A (P.F=0.5), the transformers being connected to the circuit breaker via 250m long three phase overhead distribution line consisting of ACSR dog conductor in horizontal formation and 50 m long single core 500 MCM, XLPE insulated aluminum cable.

Since the type of chopping whether true or virtual that might be expected in a given condition and the resulting over voltages in a particular type of chopping depend largely on the parameters of the supply and load circuits, the test circuit shall be so arranged as to present the actual service conditions as closely as practicable. For this purpose, actual transformers may be used which should have approximately the same relevant characteristics as would be expected from the above transformer or, alternatively, the transformers may be replaced by an equivalent circuit to obtain the desired load condition. The cable and overhead line may, if necessary for practical reason, be simulated by adding in parallel equivalent lumped capacitance of the values given below between the circuit breaker under test and the transformers.

Equipment		**Equivalent Capacitance (nF)**	
		Case (i)	**Case (ii)**
i)	Cable	12	20
ii)	Overhead line	-	5.5

In addition, 170 nF capacitance to earth shall be connected in each phase on the source side of the test circuit to account for the capacitances of cable associated with and connected to other circuit breakers in the switchboard. The transformers to be used for these tests are assumed to have the following typical values for the magnetizing current, iron losses and stray capacitance. In case the characteristics values in the actual transformers are different from the pertinent values given below (slight variations, which are not likely to influence the test results, may be ignored), suitable resistance and or inductance may be connected in the load circuit in a manner to compensate for the difference.

Sr. No.	Transformer Data	No-Load Current	Iron Losses	Stray Capacitances
i)	11/33 kV 4MVA	1 % (2.1 A)	0.1 % (4 kW)	16 nF
ii)	11/0.415kV 1MVA	2 % (1.05 A)	0.15 % (1.5 kW)	6 nF

Any change or simplification of the specified circuit shall however, not be considered except with regard to its effects on test result in either type of chopping. In order to take into account, the effect of moment of contact separation on the test result, 10 to 15 opening operations shall be performed in each test condition varying the instant of switching on the voltage wave successively by about 20 electrical degrees.

7.10.3.4 **Temperature Rise**

The temperature rise test of the main circuit, auxiliary circuits & devices of the breaker when carrying rated current shall be according to IEC-62271-100. However, the limits of temperature rise specified in the relevant IEC standard shall be reduced by 10°C to account for higher ambient condition required in this specification.

Note: The quality of the coated contacts shall be such that a continuous layer of coating material remains in the contact area after type tests, otherwise the contacts shall be regarded as "Bare". Manufacturer shall specify the thickness of coating during type tests.

7.10.3.5 **Capacitor Bank Breaking Test**

The capacitor Bank Breaking test shall be carried out as per relevant IEC standard. The rated capacitor bank breaking current for circuit breakers of different current ratings are given here.

Sr. No.	Rated Current of Circuit Breaker (A)	Capacitor bank breaking Current (A)
i)	630	500
ii)	2500	1600

8.0 LOAD BREAK SWITCH

8.1 General

8.1.1 The load break switch shall generally conform to relevant IEC standard and the general requirements listed herein.

8.1.2 The load break switches shall be air break type equipped with HRC fuses suitable for installation in 12kV switchgear system for switching the load currents. The HRC fuses shall be installed on the connecting blades of the load break switch or alternatively separate HRC fuses shall be provided with load break switch for the protection of outgoing feeders. The fuse shall be refill type having continuous current rating of 200A. It shall be triple pole fixed with cast resin post insulators and manually make and break operated. The poles shall be coupled mechanically on a common base frame so as to operate simultaneously. The isolator gap shall be visible under all circumstances for safety reasons.

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

8.1.4 The load break switch shall be so designed that no dangerous leakage current can pass from the terminal of one side to any of the terminal of the other side of the switch. It shall permit locking in both the open and closed position. Mechanical indicators to show the positions shall be provided.

8.1.5 The frame of each load break switch shall be provided with a reliable earth terminal and earth connection to the earth conductor. The diameter of the clamping screw shall be at least 12mm and the connecting point shall be marked with the "Earth" symbol.

8.1.6 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 operation without impairing its reliability or current carrying capacity.

8.1.7 The load break switch shall have 3 positions as indicated in single line diagram No. PWD/TC-580. It shall be capable of being closed for connection to either bus section and the middle position shall be the "OFF" position.
As an alternative to the triple pole 3 position switch, two 3 phase switches with interlocking arrangement may be provided as shown in drawing No. PDW/TE-580 and PDW/TE-581 as applicable. The interlocks shall be such that when one switch is closed, it shall not be possible to close the other.

8.1.8 Mechanical interlocks shall be provided as under to prevent any malfunction:

a) Both the switches shall not be "ON" at the same time.
b) Locking arrangement shall be provided for the switch in "ON" and "OFF" position for safety purposes.

8.2 Ratings

8.2.1 The load break switch shall have the following ratings:

a)	Rated voltage		12kV
b)	Nominal voltage		11kV
c)	Rated current		400A
d)	Rated short time and peak withstand current (1sec)		25kA & 63kA
e)	Rated short circuit making current, peak		63kA
f)	Electrical Endurance		E1
g)	Mechanical Endurance		M1
h)	Lightning impulse withstand voltage	across isolating distance	110kV
		to earth	95kV
i)	Power frequency withstand voltage	across isolating distance	40kV
		to earth	36kV

8.3 **Tests on Load Break Switch**

8.3.1 The load break switch shall be tested in accordance with the requirements laid down herein and in accordance with IEC.

8.3.2 **Type Tests**

Duly certified and complete type test reports for tests carried out at an Independent lab acceptable to Substation Design NTDC on the Load Break switch having same design, voltage ratings shall be acceptable in lieu of actual tests. The validity of the type test reports shall be as per type test policy of NTDC. In case of non-production of the requisite type test reports or if the type test reports are otherwise not acceptable to the Design NTDC, the following tests shall be performed on the Load Break Switch having same voltage & current ratings as ordered in presence of two (02) representatives one from Design, NTDC and other from purchaser at any independent lab approved by Design NTDC at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives.

a) Dielectric tests
b) Temperature-rise tests
c) Measurement of resistance of main circuit
d) Short time withstand current and peak withstand current tests
e) Tests to prove the ability of the switch to make and break the specified currents
f) Tests to prove satisfactory mechanical operation and endurance

8.3.3 **Routine Tests**

The following routine tests shall be carried out on each load break switch by the manufacturer.

a) Dielectric tests
b) Contact resistance measurement
c) Operation tests

8.4 **Rating plate**

8.4.1 The load break switch shall be provided with a rating plate containing the following information:

a) Manufacturer's name with country of origin
b) Type and designation
c) Serial number
d) Rated voltage, kV
e) Lightning impulse withstand voltage, kV
f) Normal current, A
g) Short time withstand current
h) Weight, kg
i) Date of Manufacturing

9.0 EARTHING SWITCH

9.1 General

Earthing switch shall generally conform to relevant IEC and the general requirements listed herein. Earthing switch shall be high speed type, spring operated and independent manual operation type with rated peak withstand current of 63kA. Earthing switch shall be operated from front of the panel with suitable indication on front. Following interlocks shall at least be provided.

a) Earthing switch must be mechanically interlocked with the circuit breaker so that it cannot be operated unless the circuit breaker is in removed/test position.

b) The circuit breaker truck / carriage cannot be inserted when the earthing switch is in closed position.

9.2 Ratings

Earthing switch shall have the following ratings:

a)	Rated voltage	12kV
b)	Nominal voltage	11kV
c)	Rated Short time withstand and peak withstand current (1sec) (rms, peak)	25kA, 63kA
d)	Rated short circuit making current (rms, peak)	25kA, 63kA
e)	Rated lighting impulse withstand voltage 1) To earth and between poles 2) Across the isolating distance	 95 kV (peak) 110 kV (peak)
f)	Rated one-minute Power Frequency withstand voltage 1) To earth and between poles 2) Across the isolating distance	 36kV 40 kV
g)	Electrical Endurance	E1
h)	Mechanical Endurance	M1

9.3 Tests on Earthing Switch

Earthing switch shall be tested in accordance with the requirements laid down herein and the relevant IEC Publications.

9.3.1 Type Tests

Duly certified and complete type test reports for tests carried out at an independent lab acceptable to Design NTDC on the earthing switch having same design, ratings shall be acceptable in lieu of actual tests. The validity of the type tests reports shall be as per type test policy of NTDC. In case of non-production of the requisite type test reports or if the type test reports are otherwise not acceptable to the Design NTDC, the following tests shall be performed on the earthing switch having same voltage & current ratings as ordered in presence of two representatives one from Design, NTDC and other from purchaser at an independent lab approved by Design NTDC at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives.

a) Short time and peak withstand current tests.
b) Mechanical endurance test.
c) Test to prove short-circuit making performance of earthing switches.
d) Measurement of resistance.

9.3.2 **Routine Tests**

The following routine tests shall be carried out on each earthing switch.

a) Contact resistance measurement
b) Operation tests

9.4 **Rating plate**

The earthing switch shall be provided with a rating plate containing the following information:

a) Manufacturer's name with country of origin
b) Type and designation
c) Serial number
d) Rated voltage, kV
e) Short time withstand current
f) Weight, kg
g) Date of Manufacturing

10.0 **ENCLOSURE**

10.1 **General**

10.1.1 The enclosure shall conform in general to clause 5.102 of IEC-62271-200. All live parts including bus-bars, connections, circuit breaker, load break switches, voltage transformers, current transformers etc. shall be suitably enclosed. The degree of protection shall be IP3X and service continuity category LSC2B in accordance with relevant IEC standard. Enclosure shall be capable to meet internal arc fault criteria as per IEC 62271-200 classification IACAFLR 25kA for 0.5 sec.

10.1.2 Access to parts such as bus bars, main connections, current & voltage transformers and all other components for normal maintenance operation shall be through bolted plates or hinged doors with locking facilities.

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

10.1.4 Four grouting holes of diameter 14 mm shall be provided in the base plate of the switchgear panel.

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

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

10.1.7 For industrial, consumer and ring main panels, separate metering compartments shall be provided in which all the metering equipment, energy meters and all secondary wiring shall be housed. The over-current relay and the indicating instruments shall be mounted separately.

10.1.8 The depth for enclosure of incoming panels shall be 2400 mm maximum. The enclosure for bus coupler panel shall be fabricated in two parts i.e. load break switch compartment and breaker compartment. The two compartments shall be held together by suitable welding/bolting arrangement.

10.1.9 The cable entry bottom plates shall be made of aluminium sheet of at least 3.0 mm thickness in two parts, one fixed and other movable for adjustment of cable entry with brass cable glands.

10.1.10 Inspection windows (dully sealed) covered by a transparent polycarbonate sheet with metallic shutters shall be provided on front and back of panel at a suitable place.

10.1.11 Temperature indicators with sensors will be provided in all compartments (i.e. busbar, cable & CB) with display on front panels along with alarm function with selectable temperature range from 20 °C to 100 °C.

10.2 **Construction**

10.2.1 The enclosure shall be made of high grade wrinkle free steel sheet of minimum thickness of 2.3mm. The supporting structure and frame shall be formed from angles, channels, folded sections of sheet metal fastened together with suitable stiffeners so that the enclosure shall be rigid and self-supporting and internally sectionalized through partitions for circuit breaker, main busbar, CTs/PTs and LV instrument compartments.

10.2.2 The circuit breaker compartment includes the complete assembly of circuit breaker, interrupter and operating mechanism mounted on truck or carriage/cassette.

10.2.3 Current and voltage transformer mountings and cable termination shall be located in a separate compartment having the provision for sealing independently. The condition of cables and CTs/VTs shall be visible through inspection window.

10.2.4 Four (04) lifting eyes shall be provided for lifting the complete individual panel from corners by means of slings. The holes of the lifting eyes shall have a minimum diameter of 45mm.

10.3 **Shutter**

10.3.1 The shutter having partitioned design class PM as per IEC 62271-200 shall be provided to prevent incidental contact with live parts when the circuit breaker is in test position, in disconnected position or has been removed. They shall be earthed and if they become part of the enclosure they shall provide the degree of protection specified for the enclosure.

10.3.2 The isolating contacts shall be adequately interlocked and protected by automatic shutters with locking facility. The shutter consists of moving & fixed plates. The shutters shall be marked "BUSBARS" and "CABLE". For bus-coupler panel, shutters shall be marked "BUSBAR-1" and "BUSBAR-2".

10.4 **Vermin Proofing**

The enclosure shall be completely vermin proof with special regard to the danger of flashover both in service and isolated positions. Provision shall be made to ensure complete vermin proofing of the cable entry holes.

10.5 **Painting**

10.5.1 All interior and exterior surfaces of steel sheet enclosure shall be thoroughly cleaned, rust proofed to prepare the metal surface for painting through process of degreasing and phosphating. The paint shall have a hard-durable surface and excellent weathering and fire-resistant properties.

10.5.2 Powder coating paint with weather resistance quality shall be used.

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

10.6 **Circuit Labeling**

A plain plastic sheet of black color background with white letters in English shall be provided on each panel. The size of sheet shall be 200mm × 60mm × 3mm and it shall be fixed on the front of the enclosure.

10.7 **Metering Compartment for Industrial, Consumer and Ring Main Panels**

The metering compartment which shall house the metering equipment shall be separately lockable and sealable from the outside. This compartment will have an internal partition separating the HT side from the LT side but access to the equipment shall be possible only by breaking the main seals of the metering compartment. No access to the metering circuits shall be possible (even with the panel de-energized and the breaker trolley removed) without breaking the seals and opening the locks.

10.8 **Ventilating openings, Vent outlets**

10.8.1 Ventilating opening and vent outlets shall be so arranged or shielded that a wire of 2 mm diameter cannot be brought into a position which should reduce the insulation level of the main circuit below the specified level. Such opening may make use of wire mesh or the like provided that it shall have a suitable mechanical strength.

10.8.2 Three (03) pressure relief flaps/explosion vents having at least 200 x 600 mm shall be provided each on the roof of bus bar compartment and CTs & PTs compartment of switchgear panel and with circuit breaker compartment to quickly release of hot gases pressure within the switchgear assembly and dissipate the exhaust from an explosion due to electrical arcing within a switchgear assembly without spreading the explosive detritus, smoke, or airborne chemicals to adjacent panels. The vent outlets shall be covered by perforated aluminum sheet of 1.5 mm to 2 mm thickness. The diameter of perforations shall be 2.0 mm maximum and the center to center distance shall be 4.0 mm. The steel cover of thickness 1.25mm to 1.5mm for explosion vents shall be provided. All the four corners of explosion vents shall be spring loaded. The design of vents shall prevent entry of dust.

11.0 BUS-BARS

11.1 Copper bus bars (one set for each phase) made of 99.9% IACS electrical conductivity shall be provided. Test reports as per relevant standard shall be submitted with the bid.

11.1.1 The size of main bus-bars for connections to adjacent panels shall be as under:

Incoming, Outgoing, Bus-coupler, Consumer and Capacitor bank control panels	2×100mm×10mm
Industrial and ring main panels	1×60mm×5mm/300mm^2 (area)

11.1.2 The size of dropper bus-bars for connections from main bus-bars to circuit breaker shall be as under:

Incoming and Bus-coupler panels	3×80mm×10mm
Outgoing, Consumer, Capacitor bank Control, Industrial and ring main panels	1×60×5mm

11.1.3 All bus bars shall be tin plated and firmly jointed according to drawing no. PDW/DF/297. The bus bars shall be capable of being extended without difficulty on either side.

11.2 Insulators/Bus-bar Supports

The bus bars shall be supported on cast resin insulators. The insulators shall conform to relevant international standard and shall be free from imperfection of all sorts. The standard color of the glaze shall be brown. The characteristics of the insulators shall be as under:

Sr. No.	Characteristics	Ratings
a)	Minimum creepage distance	300 mm
b)	Dry arcing distance (min.)	175 mm
c)	Dry one-minute power frequency withstand voltage	50 kV
d)	Lightning impulse withstand voltage	95 kV
e)	Failing load bending	10 kN

Duly certified complete test reports carried out as per relevant IEC from an independent lab on offered insulators by the manufacturer having same design characteristics, shall be provided. Name of manufacturer should be embossed on the insulator.

11.3 Bus-bar Insulation

The bus bars including droppers, connections to CT/PTs and surge arrestors shall be completely covered with insulation of red color capable of withstanding Power Frequency voltage for one (01) minute. The insulation shall be of non-corrosive, non-tracking, flame-retardant and heat shrinkable type to ensure that it fully adheres to bus-bars. The manufacturer's name or trade mark shall be printed on the insulation sleeves. Sleeve used should be subject to prior approval by Design NTDC. The material of insulating sleeves and bus bar joint covers shall not melt, crack, split, drip, flow or

ignite when busbar temperature is raised to 280 deg. C. by an induced current nor shall burn when subjected to effects of power arc of 15 kA for one second. The supplier shall provide test reports of the above-mentioned properties in accordance with IEC/ ASTM or equivalent standard.

12.0 RELAYS

All protection relays used in 11KV switchgear panels shall be numeric type except Trip & Auxiliary relays and all relays shall be subjected to approval by NTDC. For this purpose, NTDC Specification P-151:2008 (amended to date) will be followed.

12.1 General

12.1.1 The relay shall be designed, manufactured and tested according to relevant IEC standards. The switchgear panel manufactures shall furnish at least three years warranty for the relays from the date of supply of switchgear.

12.1.2 The relays shall be of the back connected, dust proof, flush mounting on the front of the switchgear with connections at the rear.

12.1.3 Relays for incoming, outgoing, consumer and capacitor bank control panels shall operate on 110V DC with a tolerance of +20% and -15%. DC-1 & DC-2 auxiliary supplies automatic changeover circuit be designed for redundant power supplies to said relays. However, for industrial and ring main panels, the relays shall be arranged to operate on AC or any alternate arrangement in case of operation of relay on DC with the approval of Chief Engineer (S&S) NTDC.

12.1.4 Separate and independent relays shall be provided for each protection function except where it is specified that built-in function of relay shall be used.

12.1.5 All protection, control and measurement devices and components shall be approved by NTDC.

12.1.6 All protection relays shall be provided with at least six (06) output contacts and one (01) live status contact for healthiness of relay. Binary inputs shall be provided as per requirement of the scheme.

12.1.7 The independent test blocks shall be provided with each protection relay to facilitate testing by secondary injection test set via test plugs without disconnecting any wire or permanent connection and without affecting the other devices and protection functions. Moreover, test blocks shall be wired in such a manner that trip and alarm from the device and DC supplies to the devices are interrupted upon insertion of the test plug. The test block shall permit to supply test currents and voltages into the individual relays during testing. The CT circuit, PT circuit, DC power supplies and trip outputs to each protective device shall be routed through the test blocks.

12.1.8 Test blocks shall isolate the trip contacts of main protection relays on both sides. Injection sockets shall be arranged so that it shall not be possible to open circuit the current transformer secondary circuits when inserting test plugs. The trip functions shall be blocked when inserting the test plugs.

12.2 Ratings

12.2.1 System frequency is 50 Hz and continuous operating temperature shall be in range from -40^{0}C to 75^{0}C (min.)

12.2.2 Unless otherwise specified, the current circuit for the relays shall be suitable for 5A, 50Hz and voltage circuit shall be rated for 63.5V, 50Hz (Ph-N) or 110V, 50Hz (Ph-Ph).

12.2.3 The performance of the relay contacts shall be in accordance with IEC 60255-1.

12.2.4 Relays shall be capable of withstanding for one minute:

a) When a voltage of 2kV AC, 50Hz is applied on control wiring, MCB, relay, measuring equipment, tripping & closing coil of circuit breaker etc. to test Insulation from ground.

b) When 500VDC is applied on control wiring to test insulation from ground (Insulation resistance).

12.2.5 The accuracy class of all relays shall conform to the applicable requirements of approved international standards.

12.3 **Numerical Relays**

12.3.1 Relays shall be of NTDC approved types complying with IEC 60255 (British Standard 142), shall have approved characteristics, flush mounted, in dust and moisture proof cases and shall comply with BS 2011 test classification 20/40/04. The components of each relay shall be suitable for operation under the local climatic conditions.

12.3.2 The relays shall be type tested from KEMA or equivalent independent laboratory in accordance with the latest IEC standards, with particular attention to the EMI immunity.

12.3.3 **a. For NTDC Grid Stations & IPPs/SCADA Application**

All protection relays shall be of numerical type and shall have serial interface (at relay front & back) and single Fiber Optic Interface (Dual FO channel if specified) compliant with IEC-61850 standard protocol to facilitate data communication with station control system. The protection schemes shall include all hardware and software to permit both local & remote setting/interrogation/real time monitoring/fault & event evaluation from the engineering/operator work station of the control room.

b. For DISCOS (Incoming, Outgoing, Consumer, Industrial & Ring Main Panels)

All protection relays shall be provided with serial RS232/RJ45 or USB Ports interface (as the case may be) for uploading/downloading relay setting files & retrieve of fault/event records from protection relays. (Note: clause 12.3.3(a) shall be applicable only, if Discos particularly specify in tender document or the case may be the requirement of IEC-61850 compliant Fiber optic port for SAS system).

12.3.4 In case 11kV switchgear panels are installed for turnkey projects (or as specified), where Substation Automation System (SAS) are available all necessary optical distribution frames/optical splicing cassette, fiber optic cables and connectors shall be installed in panel for communication with SAS.

12.3.5 The numerical relays provided shall have following features:

a) Shall be based on digital signal processing and algorithmic based functions using multiple CPUs.
b) Programmable scheme logic.
c) Remote setting/interrogation.
d) Measured quantities displayed and real-time monitoring on laptop computer.
e) Shall be of compact design and modular software.
f) Shall have continuous self-monitoring and diagnostic features or shall have automatic relay and circuitry testing features.
g) Shall have selection functions from protection software library and shall be complete with Menu-driven user interface program.
h) Shall have serial interfaces (redundant ports at front & back) and IEC 61850 compliant single Fiber Optic port (for NTDC & IPPs) for on-line and off-line transmission of relay operation data, feeder load data, sequential event and fault recording, remote setting etc.
i) Shall have time-tagged events/disturbance record. Relay shall have facility of historic fault information of at least five system faults and on demand shall display relay operations, fault recording, protection operating times and feeder load data prior to fault etc. from each system disturbance.
j) Shall have both front and rear serial-ports for further data exploitation, equipment parameterization, retrieval of fault records etc.
k) Shall be suitable for operation based on 110 VDC and 230 VAC auxiliary power sources as specified.
l) Shall have built-in AC/AC and DC/DC converters for any of its modules required auxiliary supply other than 110V DC and 230V AC.
m) All overcurrent & earth fault protection relays shall have built-in cold load pick up & switch on to fault features.

12.3.6 The design of offered Modern numeric relays should be hardened against transient surge and over voltages caused by the CT/VT and DC circuits and associated field devices. The routing of cables shall be such as to limit interference to a minimum. Any auxiliary supplies necessary to power solid state circuits shall be derived from the main station battery and not from batteries built into the relay. Continuously energized relays including those with economy resistors will not be accepted for any application.

12.3.7 Numerical relays shall have built-in RS232/USB serial communication port at the front to communicate directly with the personal computer/laptop without converter/adopter to facilitate local interrogation, setting-up and recorded data extraction and Ethernet communication port at the rear equipped with communication software for local/remote access of data and parameter download. The relay shall have also built-in HMI (Human Machine Interface) Keypad facility for local access to relay settings, monitoring and retrieving the fault/event data recorded. Individual protection units shall be provided with an integral user interface to facilitate changes in setting and observation of indications without the use of remote communications.

12.3.8 Numeric relays shall also remain stable under conditions of Radio Interference. Radio Interference tests acceptable to the Engineer shall have been carried out by the Manufacturer and in this case RFI test reports shall be submitted for the Engineers approval. If such tests have not been carried out, the contractor shall carry out RFI tests to the satisfaction of the Engineer and submit test report for approval.

12.3.9 Hardware and Software shall be checked by software sub-routine continuously. Important components supervised shall include:

a) CPU's and associated Memory (ROM, RAM, EEPROM etc.)
b) Input signal validity (A/D converter)
c) O.S. Software
d) Protection function software
e) Watchdog and self-monitoring software
f) Output signal integrity
g) Algorithm execution / logic performance
h) Digital input conversion system
i) I/O logic points
j) Power Supply Noise/Failure
k) Internal Clock

12.3.10 Functional elements in numeric relays shall have LED indicators on the front panels to enable identification of their operation, faulted phases, zones, hardware and software status etc.

12.3.11 All numerical data communication shall comply with standard protocols.

12.3.12 The numeric relay must have user friendly software which shall also support all the previous versions.

12.3.13 **Operator Interface**

a) All numerical protection systems shall be provided with an integral local user interface, to enable communication with the relay without the use of external equipment. Any facilities provided for connection to an external computer shall be an additional feature to the local user interface. No exceptions to this requirement shall be permitted.

b) Relay serial communication facilities should allow all information which is available locally at the relay front panel to be accessed remotely. It should also be possible to carry out bulk transfer of settings and fault record information using appropriate licensed PC based software. The necessary software for communication with each relay type shall be provided as part of the contract.

12.3.14 **Identification**

Each protection relay shall have a unique identifier that is clearly visible. The software reference and issue level shall be identified. The marking of all relays shall comply with Clause 12 of IEC 60255-6.

12.3.15 Each protection relay shall be provided with LCD display facilities on which shows:

a) The current transformer ratio.
b) Voltage transformer ratio (if applicable)

12.3.16 **Settings**

Each Protection shall provide a means by which the user can easily apply the required settings, which is also secure from inadvertent operation. A display of the selected settings shall be provided on the protection relay.

12.4 **Testing Facilities**

12.4.1 Separate testing facilities shall be provided for each current and voltage transformer secondary circuit so that as to give access for testing of protection relays, metering system and associated circuits. These shall consist of test block mounted adjacent to relays, or any other testing arrangement approved by Engineer of NTDC.

12.4.2 Test facilities shall be provided for testing of the protection/signaling schemes. These facilities shall include all features necessary to permit testing with line in service with minimum risk of unwanted tripping.

12.4.3 Test facilities for testing of protection relays, metering system and associated circuits are as follows:

a) The outputs of current transformers can be short circuited to neutral and disconnection from relay circuits.
b) The output of voltage transformers can be disconnected from relay circuits.
c) Currents and voltages can be applied to relays free from any connections to the current or voltage transformers.
d) Current and voltage earth connections shall not be disturbed by use of testing devices.
e) Whilst in service, the currents and voltages can be measured without interrupting relay inputs.

12.5 **Operating Characteristics**

12.5.1 **Over Current and Earth Fault Protection Relay**

12.5.1.1 Over Current & Earth Fault Protection shall be numerical type only.

12.5.1.2 The relay shall have at least two (2) stages, each stage can be independently selectable as definite time or inverse time characteristics. The relay shall have non-directional three phase over current elements, one earth fault element along with independent instantaneous settings for phase & earth fault currents.

12.5.1.3 For capacitor protection, the relay shall also have built-in independent 2-stages high sensitive earth fault protection element which shall be used for two step capacitor unbalance detection protection. Each stage can be independently selectable as definite time or inverse time characteristics.

12.5.1.4 The relay shall have the facility of selection of following characteristics according to IEC 60255 and BS-142.

a) Standard inverse
b) Very reverse
c) Long time inverse
d) Extremely inverse
e) Definite time

12.5.1.5

a) Relay shall have adjustable settings for both operating current and time. The design of the relay being such that the setting can be carried out without taking relay out of service.

b) The range of current settings for phase fault shall cover at least 5-500 percent of rated CT current with tapings of minimum 5-percent intervals.

c) Earth fault element shall have a minimum range of setting from 5% to 120% of rated CT current with tapping of 5% interval.

d) The high set over current & earth fault element shall have a setting range of 100 % to 2500 % of rated CT current with tappings a minimum of 5-percent intervals. The tripping time of high set elements shall not be more than 20ms at current greater than two times the setting.

e) Time setting (definite time characteristic) for over current, earth fault & instantaneous elements shall be adjustable over a range of 0 to 60 sec with step size of 0.01 sec. Instantaneous elements shall have also an infinity setting.

f) Time Dial setting (Inverse Time characteristic) for both over current and earth fault elements shall be adjustable over a range of at least 0.05 to minimum 1.0 in steps not exceeding 0.01.

g) Over current & earth fault relays with built-in sensitive earth fault protection (Note: Sensitive Earth Fault Protection feature shall only be provided in case system is grounded via. Resistor or transformer or as per application required) shall have a minimum range of setting from 0.1% to 120% of rated CT current with tapping of 0.1% interval.

h) The high set Sensitive Earth fault protection shall have a setting range of 0.1% to 150 % of rated CT current with tapings of minimum 0.1% interval.

i) Time setting (definite time characteristic) for sensitive earth fault protection & its instantaneous elements shall be adjustable over a range of 0 to 60 sec with step size of 0.01 sec. Instantaneous elements shall have also an infinity setting.

j) Time Dial setting (Inverse Time characteristic) for sensitive earth fault protection shall be adjustable over a range of at least 0.05 to minimum 1.0 in steps not exceeding 0.01.

12.5.1.6 Each protection element shall have separate trip and alarm contacts and separate trip indicators. The relay shall have at least Six output configurable contacts and eight programmable LEDs.

12.5.1.7 The relays shall be thermally rated such the operating time of the relay at the highest practical current levels on combination of current and time multiplier settings shall not exceed the thermal with stand time of the relay.

12.5.1.8 The actual relay pick-up current shall not exceed 105% of relay setting and reset value shall not be less than 95% of pick-up current.

12.5.1.9 The relay shall meet with a situation of sudden change in load on switching the feeder.

12.5.1.10 The relay shall have built-in cold load pickup and SOTF features.

12.5.2 **Capacitor Unbalance Detection Relay (Built-in function of Over Current & Earth Fault Protection Relay)**

12.5.2.1 The built-in function of over current & earth fault protection relay shall be used as Capacitor Unbalance Detection protection. Capacitor unbalance detection relay is used in capacitor control panels and operates from 5A secondary of the bank neutral current transformer of Y section. The relay shall have 2-stages and each stage can be independently selectable as definite time or inverse time characteristics. The first stage of the relay shall initiate an audible alarm on the failure of one capacitor unit and the second stage shall cause tripping the circuit breaker on the failure of the second capacitor unit with audible/visible indications and lock-out action of over/under voltage relay in auto control mode. The neutral unbalance protection scheme for the capacitor bank shall consist of double star with neutral connected to the current transformer. The relay must have C.T arrangement for both capacitor unbalance & neutral unbalance protection.

12.5.2.2 The relay shall have all standard characteristics according to IEC standards.

12.5.2.3 Over Current and Earth Fault Protection shall be of Five elements, the fifth element shall be used for two step capacitor unbalance detection protection setting and shall be connected to neutral unbalance C.T. of 50/5A. For detail specification, the clause 12.6.1 above shall be followed.

12.5.2.4 This capacitor unbalance detection function can be attained by utilizing the built-in sensitive earth fault protection function of over current & earth fault relay.

12.5.3 **Over/Under Voltage Relay**

12.5.3.1 Over/Under Voltage protection shall be of numeric type. Over/Under voltage relay is used in capacitor control panels. The over voltage component of the relay shall be capable to provide capacitor protection against over voltage and facilitate auto switch OFF the capacitor bank when bus voltage exceeds a predetermined value for a preset time interval. Similarly, under voltage component of the relay switch ON the capacitor bank when bus voltage falls below a predetermined value for a preset time interval. The operation of relay shall be independent of harmonics and transients in the supply system.

12.5.3.2 The voltage and time sensitive automatic capacitor switching control shall be of single pole type flush mounted and suitable for installation in the switchgear instrument compartment on the front door. The scale and range of operation shall be suitable for switching a 7200kVAR capacitor bank. The accuracy shall be 2% of the full scale. Selector switches shall be provided for manual or automatic operation through "Automatic-Manual" and "Open-Neutral-Close" switches.

12.5.3.3 The voltage sensitive control shall measure line voltage and as function of that quantity control the relay which in turn shall operate the switchgear. The relay shall be electronically controlled with an adjustable time delay. The instrument shall also be provided adjustable bandwidth range for setting switching IN and OUT voltages so that little variation in voltage shall not cause hunting.

12.5.3.4 The relay shall have V.T. fuse failure feature and binary input for detecting P.T. MCB trip status and on operation of P.T. fuse failure Alarm shall be generated and lockout relay be operated for tripping of circuit breaker and close block.

12.5.4 **Trip & Lockout Relay**

12.5.4.1 Trip & lockout relay, shall be required for over current & earth fault protection and capacitor unbalance detection protection for safety reason, in order to close block operation of circuit breaker due to operation of protection relays in capacitor protection panel. It shall be electromechanical, draw out, high burden, hand and electrically reset, hand reset mechanical indication or flag, high speed and of multi-contact construction complying with E.A (ESI) standard 48-4, Class EB2. The relay coil shall be designed for continuous operation of 110 V DC with tolerance of +20% and -15%. The high burden relays shall be immune to AC and capacitance discharge current.

12.5.4.2 Lockout relays shall have at least five (5) years field proven experience. The contact arrangement shall consist of at least 3 NO and 2 NC contacts. Number of relays shall commensurate with the requirement of the protection scheme. The contact rating shall not be less than the following:

Contract Rating	Make and Carry Continuously	Make and Carry for 3-Seconds	Break
AC	1250 VA with maximum of 5A 300 V	7500 VA with maximum of 30 A and 300 V	1250 VA with maximum of 5A and 300 V
DC	1250 W with maximum of 5A and 300 V	7500 W with maximum of 30 A and 300 V	100 W resistive 50 W inductive (L/R=0.04s) with maximum of 5A and 300 V

12.5.4.3 The relays shall be suitable for flush mounting on the front of the cubicle with connections made at the rear of the case.

12.5.4.4 Tripping relay contacts shall be suitably rated to satisfactorily perform their required duty and relay operating time shall not exceed 10 ms from initiation of trip relay operating coil to contact close.

12.5.4.5 Resetting of the indicator and the contact shall be possible without having to open the relay case.

12.5.4.6 The operation and reset coils of electrically reset table trip relays shall have internal cut-off contacts.

12.5.4.7 The contactor/supplier shall submit test evidences of mechanical durability performance of the offered relays for both loaded contacts and un-loaded contacts.

12.5.4.8 The mechanical durability shall be 10,000 operations (minimum) with loaded contact.

12.5.5 **Trip Circuit Supervision Relay**

12.5.5.1 Two (02) Nos. Separate/independent Relays shall be provided for Trip Circuit Supervision.

12.5.5.2 The relay shall be electronic/electromechanical, flush mounted, dust proof, draw out type, hand reset flag with indication target to be reset manually.

12.5.5.3 The trip circuit supervision scheme shall provide continuous supervision of the trip circuits of the circuit breaker both in the open or closed position and independent of local or remote selection at the local operating position. The supervision relay shall include D.C. supply voltage, trip coils, all interconnected cables, auxiliary contacts for trip coils, trip circuit etc.

12.5.5.4 The relay shall also initiate an alarm if the trip supply or auxiliary supply voltage fails. The relay shall be equipped with at least 2 normally open and two normally closed contacts or alternately four 2-way changeover contacts. All contacts for alarm functions shall be volt-free, self-reset.

12.5.5.5 The relay shall have time delay (200 ms) on drop off to avoid mal-operation & to prevent spurious alarms due to voltage dips caused by operation of other equipment or fault in other circuits.

12.5.5.6 The relay shall not only monitor the presence of DC supply but also its level. It shall have provision for initiating a visual indication and audible alarm when the DC voltage falls below 80%.

12.5.6 **Auxiliary Relays**

12.5.6.1 Auxiliary relays shall be of rugged construction and shall have a high degree of reliability even when they have been idle for long periods of time. All auxiliary relay coils and contacts shall be suitable for continuous operation at 110 V DC for 11 KV system with a tolerance of + 20% and -15 %. The relay coils shall be so designed that their consumption is kept to a minimum and yet sufficient contact pressure is ensured when the relay operates to make contacts. The continuous current carrying rating of the contacts make and make rating shall not be less than 5A at 110 V DC.

12.5.6.2 Auxiliary relays shall be of instantaneous type or time delayed as required. The time delay provided in the relays shall not be affected by changing temperature or humidity. Auxiliary and contact multiplier relays in the tripping circuits shall be of high speed type and equivalent or better than class-I relays as defined in IEC-60255.

12.5.6.3 Manual reset auxiliary relays shall be high speed, multi-contact type with operation indicator.

12.5.6.4 Self-reset auxiliary relays shall be for rear of panel mounting, front-connected type.

12.5.6.5 Auxiliary tripping relays shall be self-reset, front-connected type suitable for rear-of-panel mounting.

12.5.6.6 The operative speed of auxiliary relays shall be within 4 to 10 ms depending on application.

12.5.7 **Coils**

12.5.7.1 The current coils of the numerical relays shall withstand the thermal and mechanical stresses at least 35 times the continuous current rating of the coil for one half second or 20 times the continuous rating of the coil for 3 seconds without damage to coil or associated mechanical or electronic components. The continuous rating shall be twice the rated current, with the specified temperature rise.

12.5.7.2 Voltage coils shall withstand thermal stress due to continuous energization at voltage 25% in access of the rated voltage at all settings of the relays.

12.5.9 **Indications**

Operation indicators shall be provided on all elements of relays and shall be designed for hand resetting.

12.5.10 **Test Devices**

Relays shall incorporate test devices which shall be mounted on front of panel so that testing can be carried out from the front of the panels using test plug. The test devices shall be so arranged that the current transformer secondary circuits cannot be open circuited at any position while test plugs or covers are being inserted or removed.

12.5.11 **Testing and Inspection**

12.5.11.1 **General**

12.5.11.1.1 Testing of relays and their components shall be performed in line with NTDC specification, and in accordance with the relevant IEC standards.

12.5.11.1.2 Protection relays and their components shall be subjected to routine tests as per the relevant international standards. Protection relays mounted in cubicles shall be completely wired, tested and inspected. Routine test certificate as per relevant IEC standards shall be submitted to NTDC/DISCOs along with relay.

12.5.11.2 **Routine Tests**

Routine tests shall not be limited to but should cover at least the following:

Secondary injection, scheme checks, relay logic, performance of engineer interface, functional-trip tests, setting ranges and calibration accuracy, response (trip) times, functional availability and application limits, system supervision, performance of communication interfaces with PCMS, events and disturbance records etc.

12.5.12 **Operation and Maintenance Manual of Protection, Control & Monitoring Equipment/Relays**

12.5.12.1 The supplier shall submit operation and maintenance instruction manual to the purchaser.

12.5.12.2 The complete manuals must be provided to NTDC/DISCOs before the delivery of relays or panels. Information in the manuals and documentation for relay system shall not contain less than the following:

a) Specification and characteristics.
b) External connections.
c) Description and drawing of the construction and principle of operation. Additionally, for relay systems, the module layout in interconnection diagrams, internal wiring and component descriptions. For numerical relays, details / information of all applicable software, interfaces, marshalling of BI/BO contacts, programming, optional features etc. shall be provided.
d) All setting calculation instructions explained with examples.
e) All setting and calibrations procedures and instructions.
f) Receiving inspections and acceptance test on instructions.
g) Installation requirements and instructions.
h) Routine maintenance requirements and instructions.

i) Repair and recalibration instructions.
j) Parts list.
k) Design test report.
l) Original manufacturer's instruction manuals and documentation (detailed information of basic and optional features if any) and not brochures shall be provided to Protection & Control department NTDC/DISCOs to acceptance of relays or relays system. Photocopies of manuals shall not be acceptable (i.e. all manuals shall be original as issued by Relay Manufacturers).

12.6 **Rating Data**

The relays shall have a rating data marked with at-least the following:

a) Manufacturer's name
b) Year of manufacture
c) Type of relay
d) Serial number
e) Country of origin
f) Ordering code along with detail ordering sheet
g) Detailed technical catalogue
h) Voltage and frequency etc. as applicable
i) Setting ranges

13.0 **CURRENT TRANSFORMER**

13.1 The current transformers shall be single pole epoxy resin insulated, dry type, self-contained suitable for indoor mounting and shall be tested in accordance with relevant IEC and particular requirements listed herein. The class of insulation shall be at least "E" type.

13.2 The current transformers shall be provided with a steel mounting base as per drawing No. PDW/DF-445 which shall be securely attached to the casting and shall have coating to withstand the weather conditions.

13.3 For dual ratio current transformers, ratio shall be obtained by tapings on the secondary side only. The ratio(s) of current transformer shall be printed on the CT body.

13.4 For Consumer, Industrial and Ring main panels, two separate sets of single-core current transformers i.e. one for over-current protection and the other for metering shall be provided. The metering current transformers shall have necessary provisions for sealing of the secondary terminal box besides being located in a separate independently sealable compartment.

13.5 The transformation ratios required for various types of switchgear of different ratings shall be as follows:

13.5.1 **Over-current Protection & Metering**

Sr. No.	Type of Switchgear Panel	Ratings (Amps)
a)	Incoming panel	2400:1200/5-5Amps or 1600:800/5-5 (as per requirement)
b)	Outgoing and capacitor bank control panels	600:300/5-5
c)	Industrial and ring main panels — Protective and metering CT (as specified by the purchaser)	100/5 or 150/5 or 200/5 or 300/5 or 600/5
d)	Consumer panel — Protective CT — Metering CT	600:300/5 600:300/5
e)	Outdoor capacitor bank neutral current transformer of protection class	50 / 5

13.5.2 **Differential Protection**

Incoming panel	2400:1200/5Amps or 1600:800/5 Amps (as per requirement)

13.6 **Rating and characteristics**

The rating and characteristics of the current transformers shall be as under:

Sr. No.	Type designation	Metering (M)	Protection (P)	Metering and Protection (MP)
a)	Rated Voltage, Um, kV, rms	12	12	12
b)	Nominal voltage, Un, kV, rms	11	11	11
c)	Rated frequency, Hz	50	50	50
d)	Rated Secondary Output:			
	- Measuring winding: VA.	10		10
	- Protective winding: VA.	-	15	15
e)	Accuracy Class:			
	- Measuring winding.	0.5FS10[a]	-	0.5FS10[a]
	- Protective winding.	-	5P20	5P20

Sr. No.	Type designation	Metering (M)	Protection (P)	Metering and Protection (MP)
f)	Short time current rating at all ratios, kA			
	- Thermal, Ith	25	25	25
	- Dynamic, Idyn	63	63	63
g)	Rated short-circuit duration, sec.	1	1	1
h)	Accuracy limit factor for protection core	-	20	20
i)	One-minute power frequency withstand voltage, kV			
	- Primary winding	36	36	36
	- Secondary winding	3	3	3
j)	Impulse withstand voltage, 1/50 μ sec., kV Peak	95	95	95
k)	Temperature rise, °C , Max.	40	40	40
l)	Partial Discharge, (Maximum) Um, pC 1.2Um/√3	 50 20	 50 20	 50 20

Notes:

a) Panels provided with Power Quality Analyzer shall have Metering C.T. accuracy class of 0.2s.

b) The VA burden of CTs mentioned in table is at secondary lowest tap position and shall be multiplied correspondingly on higher taps.

13.7 **Rated Continuous Thermal Current (Icth)**

The current transformer shall be capable for continuous operation at 1.2 times the rated current.

13.8 **Temperature Rise**

13.8.1 The temperature-rise of the current transformers when carrying primary current equal to the rated continuous thermal current (1.2 times the rated current) with a unity power factor & burden corresponding to the rated output under service conditions shall not be more than 40°C.

13.8.2 Test shall be carried out as per relevant IEC standard.

13.9 **Markings**

The terminals P1 & P2 shall be printed in the CT body. The marking shall carry at least the following information in an indelible manner. No sticker is allowed.

a) Manufacturer's name & trade mark

b) Serial number and type designation
c) Rated primary and secondary currents
d) Rated voltage
e) Rated frequency
f) Rated output and corresponding accuracy class for each core
g) Rated insulation level (e.g., 36/95kV)
h) Rated thermal and dynamic currents (e.g. 25/63kA)
i) Class of insulation
j) For CTs with dual secondary windings, the use of each winding and its corresponding terminals
k) Rated continuous thermal current (e.g., Icth = 120%)

13.10 **Tests on Current Transformers**

13.10.1 Tests shall be performed in accordance with the procedure mentioned in relevant IEC Publication by the manufacturer and the test report shall be submitted.

13.10.2 **Routine Tests**

The following routine tests shall be made on each CT as per relevant IEC.

a) Verification of terminal markings.
b) Power frequency withstand test on primary windings.
c) Power frequency withstand test on secondary windings.
d) Inter-turn over voltage test.
e) Partial discharge measurement
f) Measurement of the resistance of primary and secondary windings. The measured resistance should not exceed the resistance of the type tested CT and approved by Design NTDC.
g) Accuracy tests with 20%, 100% and 120% of rated current (for metering core only).
h) Composite error, current and phase displacement measurements (for protection core only).

The number of current transformers to be tested for accuracy tests and partial discharge test shall be the nearest higher whole number to the cube root of the number of current transformers to be supplied with panels or in loose. If one specimen fails to meet the requirements of any individual test specified above, a second sample shall be selected at random from the same lot. Failure of any specimen from the second sample shall cause rejection of the entire lot.

13.10.3 **Type Tests**

Duly certified complete type test reports for the following tests carried out on Current Transformers at an independent lab having same design, ratios, current & voltage ratings shall be acceptable in lieu of actual tests. In case of non-production of the requisite type test reports or if the type test reports are otherwise not acceptable to the Design NTDC, the following tests shall be performed on the Current Transformer having same ratings and design as ordered in presence of two representatives one from Design, NTDC and other from purchaser at any independent lab approved by design NTDC at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives. The validity of type tests shall be per type test policy of NTDC.

a) Short-time current tests.
b) Temperature-rise test.
c) Lightning impulse withstand voltage test.
d) Measurement of the resistance of primary and secondary windings.
e) Power frequency voltage withstand test at Primary & secondary windings.
f) Inter-turn over voltage test.
g) Partial discharge measurement.
h) Accuracy test (for metering core only).
i) Test for composite error, current error and phase displacement measurement (for protection, cores only).
j) Instrument security current tests (for metering cores only).

13.11 **Data and Drawings to be submitted for approval**

a) Schedule of technical data.
b) Excitation curve.
c) Typical composite error curves for the standard burden from 0 to 20 times rated secondary current for protective current transformers.
d) Overall assembly drawing showing front, side and plan views and sufficient cross-sectional views clearly showing the transformer.
e) Dimensional drawings of mounting base and terminals.
f) Side view photo of current transformer.

14.0 VOLTAGE TRANSFORMERS

14.1 The voltage transformers shall be single pole epoxy resin insulated, dry type, self-contained suitable for indoor mounting and shall be tested in accordance with relevant IEC and particular requirements listed herein. The class of insulation shall be at least "E" type.

14.2 The voltage transformers shall be provided with a steel mounting base which shall be securely attached to the casting and shall have coating to withstand the weather conditions.

14.3 The voltage transformer shall be so installed as to be energized prior to the closing of the breaker for incoming, industrial & ring main panels and shall be capable of convenient isolation from the bus bars. For protection against short circuit on secondary side, a triple pole AC miniature circuit breaker shall be installed in the instrument compartment.

14.4 **Rating and characteristics**

The rating and characteristics of the voltage transformer shall be as under:

Sr. No.	Type designation	Rating
a.	Rated Primary Voltage, Um, kV rms	12
b.	Nominal Primary voltage, Un, kV rms	11
c.	Nominal Secondary voltage, Un, V rms	110
d.	Rated frequency Hz	50
e.	Rated Secondary Output, VA	100

Sr. No.	Type designation	Rating
f.	Accuracy Class:	0.5
g.	Rated Voltage Factor,	
	- Continuous duty,	1.2
	- 30 second duty,	1.5
h.	Rated Insulation Level, kV	
	- Power Frequency withstand Voltage of Primary winding	36
	- Impulse withstand voltage, 1/50 μ sec., kV Peak	95
i.	Power Frequency withstand Voltage of Secondary winding	3
j.	Partial Discharge: Um, pC 1.2Um/√3, pC	 50 20
k.	Short circuit withstand duration, sec.	1

14.5 **Temperature-rise**

14.5.1 The temperature-rise of the voltage transformer at the specified voltage, at rated frequency, at rated burden and at any power factor between 0.8 lagging and unity under service conditions shall not be more than 40°C. The voltage to be applied to the voltage transformer shall be 1.2 times the rated primary voltage.

14.5.2 Test shall be carried out as per relevant IEC standard.

14.6 **Short-circuit Characteristics**

14.6.1 Voltage transformer shall be capable of withstanding the mechanical and thermal stresses for one second resulting from short-circuit on secondary terminals with full voltage maintained on the primary terminals. The Voltage Transformer shall be energized from the primary side at rated voltage and the short circuit current applied between the secondary terminals for duration of 1s. The test may be carried out by energizing the secondary winding and applying the short circuit between the primary terminals of voltage transformer.

14.7 **Markings**

The marking shall be in accordance with relevant IEC standard. The marking shall carry at least the following information in an indelible manner. No sticker is allowed.

a) The manufacturer's name & trade mark
b) Serial number and type designation
c) Rated primary and secondary voltage
d) Rated frequency
e) Rated output and accuracy class (e.g., 100VA Class 1.0)
f) Class of insulation
g) Rated insulation level (e.g., 36/95kV)

h) Rated voltage factor and corresponding rated time (e.g., 120% continuous &150% for 30s)
i) Connection diagram and polarity marking

14.8 **Tests on Voltage Transformers**

Tests shall be performed in accordance with the procedure mentioned in relevant IEC Publication and the test report shall be submitted for approval of design NTDC.

14.8.1 **Routine Tests**

The following routine tests shall be made as per relevant IEC standard.

a) Verification of terminal marking
b) Power frequency withstand voltage test on primary windings
c) Power frequency withstand voltage test on secondary windings.
d) Partial discharge measurement.
e) Determination of errors according to requirement of accuracy class.
f) Measurement of resistance of primary and secondary winding. The measured resistance should not exceed the resistance of the type tested PT and approved by Design NTDC.

The number of voltage transformers to be tested for accuracy tests and partial discharge test shall be the nearest higher whole number to the cube root of the number of voltage transformers to be supplied with panels or in loose. If one specimen fails to meet the requirements of any individual test specified above, a second sample shall be selected at random from the same lot. Failure of any specimen from the second sample shall cause rejection of the entire lot.

14.8.2 **Type Tests**

Duly certified complete type test reports for the following tests carried out on voltage transformer at an independent lab having same design, ratios & voltage ratings shall be acceptable in lieu of actual tests. In case of non-production of the requisite type test reports or if the type test reports are otherwise not acceptable to the Design NTDC, the following tests shall be performed on the Voltage Transformer having same ratings and design as ordered in presence of two representatives one from Design, NTDC and other from purchaser at any independent lab approved by design NTDC at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives. The validity of type tests shall be per type test policy of NTDC.

a) Temperature-rise test.
b) Lightning impulse voltage test.
c) Power frequency withstand voltage test on primary windings.
d) Power frequency withstand voltage test on secondary windings.
e) Measurement of resistance of primary and secondary winding.
f) Short circuit withstand capability test.
g) Determination of errors.
h) Partial discharge measurement.

14.8.3 **Data and Drawings to be submitted for approval**

a) Schedule of technical data.
b) Overall assembly drawing showing front, side and plan views and sufficient cross-sectional views clearly showing the transformer.
c) Dimensional drawings of mounting base and terminals.
d) Side view photo of voltage transformer.

15.0 CONTROL WIRING AND TERMINATION

15.1 Control cable used in wiring shall be of 600V grade multi stranded copper wires and shall conform to NTDC specification P-100 (Amended to date). Voltage circuit shall be made with **2.5mm²** cable and current circuit with **4mm²** cable. All control wiring shall run through steel channels with removable covers in HV compartment. In instrument compartment, the wiring shall be routed through PVC trays.

15.2 Each wire shall be identified by machine lettered permanent printed at least 50mm from the end of wire or plastic identification ferrules. Ground wire has no number and identified by cable color. Following color identification shall be applied:

3-phase AC	1-Phase AC	DC	Color
Phase 1	Phase	Positive	Red
Phase 2	-	-	Yellow
Phase 3	-	-	Blue
Neutral	Neutral	Negative	Black
Ground	-	-	Green

15.3 Each switchgear panel shall be supplied with necessary length of control wiring required for interconnection complete with adjacent panel.

15.4 **Termination**

15.4.1 The control wiring shall be terminated in a terminal block. The terminals shall be tinned copper and may be crimped or compression applied. Only one wire shall be terminated in a terminal block. Termination of more than one wires in a terminal block is not allowed.

15.4.2 Terminal blocks shall be mounted on the rails. Each row of the terminal blocks shall be covered with end plates/brackets. The rated cross section of terminal blocks used in voltage & current circuits shall be 4mm² & 6mm² respectively. Terminal blocks used in current circuit shall be supplied with movable short circuit plates/links covered with insulating material on one side along with screw type test socket quipped with sleeve. Provision shall be available in terminal block for fixation of push-on marking tag. The marking tag shall consist of white background with black printing with max. of three characters.

15.4.3 Terminal blocks shall conform to the requirements of IEC 60947-7-1. Duly certified complete test reports from an independent lab carried out by the manufacturer having same design & ratings shall be provided.

15.4.4 Terminal blocks for AC & DC circuits shall be placed separately. 10% spare terminal blocks of each type shall be provided in the panels. Terminal blocks shall be provided with a slip-on cover of transparent polycarbonate material to avoid any accidental touch.

16.0 INSTRUMENTS

16.1 The instruments installed on the panels shall conform to IEC 60051 and the requirements listed herein. AC moving iron analogue instruments shall be semi flush mounted, back connected, dust proof, having a removable transparent dust tight window cover with a dull black finish and having facility to change the scale from top with or without opening the instrument. The size of instrument shall be 96mm × 96mm unless otherwise specified. The zero adjuster will be provided outside the instrument.

16.2 Power Factor Meter

The Power factor meter shall be suitable and robust enough to withstand the momentary high disturbances without damage or loss of accuracy and comply with the following ratings, characteristics:

Sr. No.	Characteristics	Ratings
a)	Voltage input	110 V
b)	Current input	5A
c)	Accuracy class	1
d)	Rated frequency	50 Hz
e)	Scale range	Lead 0.5 - 1- 0.5 Lag

16.3 Ammeter

16.3.1 The ammeter shall be suitable and robust enough to withstand the momentary high current arising in the circuits during short-circuit conditions without damage or loss of accuracy and comply with the following ratings, characteristics:

Sr. No.	Characteristics	Ratings
a)	Current	1.2 In continous 5.0 In for 30s 10 In for 5s 40 In for 1s
b)	Accuracy class	1
c)	Rated frequency	50 Hz
d)	Secondary current of CT	5A

16.3.2 The full-scale values of ammeters for use with the current transformers shall be 125% of full scale value.

16.4 **Voltmeter**

The Voltmeters shall be suitable and robust enough to withstand the momentary high disturbances without damage or loss of accuracy and comply with the following ratings, characteristics:

Sr. No.	Characteristics	Rating
a)	Voltage	1.2 Vn continous, 2.0 In for 5s
b)	Accuracy class	1
c)	Rated frequency	50 Hz
d)	Secondary voltage of VT	110V
e)	Scale range	0 – 15kV

16.5 **Power Quality Analyzer**

The Power Quality Analyzer shall be suitable and robust enough to withstand the momentary high disturbances without damage or loss of accuracy and comply with the following ratings and characteristics.

1. Panels provided with Power Quality Analyzer shall have Metering CT accuracy class of 0.2s.
2. Power Quality Monitoring equipment/analyzer shall be installed in accordance with EN 50160, IEC 61000-4-30, IEC 61000-4-7, IEC 61000-4-15 & IEC 62586-1 standards.
3. It shall fulfill the highly precise energy management tasks and shall have an accuracy class of 0.2s according to IEC 62053-22 and Class A category according to IEC 61000-4-30.
4. It shall fulfill graphical display with back ground illuminated and transparent front cover and its size shall be preferably 144mm x 144mm.
5. It shall have flush mounting design.
6. It shall have four inputs for AC voltage measurements & 4 inputs for AC current measurements with in/out arrangement.
7. It shall operate on both DC & AC supply voltage:

    a) DC supply voltage 70V to 250V with ± 20% tolerance
    b) AC supply voltage 110V to 240V with ± 20% tolerance 50Hz

8. The typical life of battery shall be:

    a) 10 years for operation with permanently applied supply voltage
    b) At least 02 months over a 10 years' period for operation with sporadically interrupted supply voltage.

9. It shall be capable to measure the following electrical parameters:

    a) Voltage (Phase-N, Phase-Phase)
    b) Current per phase
    c) Power Frequency
    d) Active, Reactive & Apparent Power (Import/Export) in four quadrants
    e) Power factor and active power factor

f) Phase Angle
g) Unbalance voltage & current
h) Harmonics of AC voltage & current are stored up to the 40th order for evaluation
i) THD (Total Harmonic Distortion) of AC voltage & current
j) Flicker

10. It shall monitor the following minimum power quality parameters of Electrical Network as per IEC/EN standards.

a) Power Frequency distortions
b) Power frequency dips
c) Magnitude of Supply voltage and currents and other electrical parameters.
d) Flicker instantaneous, short and long.
e) Supply voltage dips/sags
f) Supply voltage swells
g) Short and long supply Voltage interruptions
h) Transient under/over voltages and currents.
i) Supply voltage unbalance and variations
j) Supply Voltage and current harmonics and THD
k) Supply Voltage and current inter harmonics
l) Mains signaling voltage on the supply voltage/noises
m) Rapid voltage changes
n) Measurement of under deviation and over deviation parameters

11. All parameters shall be fully configurable.
12. Both measurements and events shall be recorded at different time intervals. PQM shall be capable to provide following functions according to EN/IEC standard.

a) Measured recorder
b) Event recorder
c) Trent recorder
d) Waveform captures
e) Load profile
f) Transient log

13. The PQM shall have serial/RJ45/USB interfaces as the case may be for programming of PQM and configuration of electrical parameters and real time monitoring of electrical parameters on laptop computer via PQM software.
14. It shall have at least 8-GB memory for recording recorder data. The store data shall be exported automatically & transmitted to remote station computer/SAS via software and shall be shown in tabular and graphical forms and to generate different standardized power quality reports according to EN 50150 NS & MS or EN 50160 HS or generate use defined reports.
15. The PQM shall have front keypad for manual configuration of electrical parameters.
16. The PQM shall be equipped with RS485 or RJ45 or any other communication port with communication protocols. It shall also be capable to interface with different or same type of PQM devices for development of integrating network and for remote interrogation of PQM data on remote station computer for monitoring and programming of PQM meters and time synchronization in case of DISCOs network.

17. In case of IPPs/NTDC system the PQM shall have IEC 61850 complaint single Ethernet port for communication, monitoring, programming and GPS time synchronization via SAS.
18. The measured/monitoring values shall be recorded with date & time stamps.
19. It shall have at least two binary inputs & outputs.
20. Its degree of ingress protection shall be [P5].
21. The supplier/contractor shall supply all the necessary software for programming of PQM to export recorded data from PQM i.e. measured recorder, event recorder, trend recorder, waveform captures, load profile recording & transient log to station PC & remote-control center for storage & further evaluation/analysis along with connectors, programming and network communication cables and allied aux. equipment without any additional cost and shall be part of supply/contract.

16.6 **Scale Marking**

16.6.1 Marking and symbols of instrument shall be in accordance with IEC 60051. Scale plates shall have a permanent white finish with black graduation and numerals marked at 90 °. The marking shall carry at least the following information in an indelible manner.

a) Accuracy Class.
b) Transformation ratio.
c) Manufacturer's name & country of origin.
d) Scale range calibrated in Red if exceeds the nominal C.T. or P.T. value.

16.6.2 For the instruments which are used in conjunction with current transformers, the number of scales shall be in accordance with the number of CT ratios available on the connected current transformers, there being a separate scale plate for each ratio.

16.6.3 The required number of scale plates 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. The CT ratio shall be prominently marked on the dial plate. The scale marking shall be evenly distributed between 10% & 100% of the scale range.

16.6.4 Instruments shall conform to the requirements of relevant IEC standard. Duly certified complete test reports from an independent lab carried out by the manufacturer having same design & ratings shall be provided.

17.0 **ENERGY METERS**

The energy meters shall conform to the NTDC specification P-202:2012 amended to date "Energy Meters for Grid Metering".

18.0 **MINIATURE CIRCUIT BREAKERS**

18.1 Miniature circuit breaker shall withstand a continuous duty and shall carry the rated current without exceeding the specified temperature-rise. The rating of MCB shall be as under:

i.	Rated voltage	250 V AC or 110V DC (as applicable)
ii.	Rated current	10 A
iii.	Rated breaking current	10 kA
iv.	Maximum operating time	< 500 m/s (at rated breaking current)

18.2 0Each MCB shall have at least two auxiliary contacts. The power source signaling light shall be 110 VDC.

18.3 DC MCBs shall be used in DC circuits. AC or universal type MCBs shall not be accepted in lieu of DC MCBs.

18.4 MCBs shall conform to the requirements of relevant IEC standard. Duly certified complete type test reports from an independent lab carried out on MCBs by the manufacturer having same design & ratings shall be provided.

19.0 **RATING PLATE**

19.1 The rating plate for each complete panel shall be fixed on the front side of the enclosure as shown in drawing No. PDW/DF-299. The plate shall be made of stainless steel or Aluminium of at-least 1mm thickness. The plate shall be marked with the following engraved text in black color:

i) Switchgear Panel Manufacturer's name
ii) CB manufacturer's name & Country of origin.
iii) Type/designation of CB
iv) Panel serial number
v) Year of manufacture
vi) Rated voltage
vii) Frequency in Hz
viii) Rated insulation level:

a. Lightning impulse withstand voltage
b. Power frequency withstand voltage

ix) Current rating of the Circuit Breaker:

a. Continuous at 50 °C
b. Short-time

x) Rated short-time withstand current (for main and earthing circuits)
xi) Rated peak withstand current (for main and earthing circuits)
xii) Rated duration of short circuit (for main and earthing circuits)
xiii) Current transformation ratio of the CTs installed:

a. Metering
b. Protection
c. Differential

xiv) Voltage ratio of voltage transformers where applicable
xv) Diagram of connections as per drawing No. PDW/TE-850
xvi) Weight:

a. Circuit breaker
b. Total

xvii) Contract/Purchase Order No. and date
xviii) Reference standard

19.2 The rating plate for circuit breaker, load break switches, relays, instrument transformers, instruments and energy meters shall be fixed on the equipment as specified in the respective clauses.

19.3 **Operating Instruction Plate**

19.3.1 An operating instruction plate indicating all necessary steps to be followed in the required sequence of operation for withdrawing and insertion operations of the circuit breaker shall be fixed right on the front of enclosure for the guidance of the operator.

19.3.2 The instruction plate shall be made of stainless steel or aluminum sheet of minimum 1.0mm thickness and so placed that it immediately catches the eyes of the operator when he intends to perform any operation of the circuit breaker.

19.3.3 The operating instructions on the plate shall be engraved in English as well as in Urdu language in black color.

20.0 **TESTS ON PANELS**

20.1 The components forming part of metal enclosed switchgear shall comply with and be tested according to the tests specified in the relevant clauses of this specification. The tests listed herein shall be made in accordance with the procedure mentioned in relevant IEC standards and as specified herein.

20.2 **Type Tests**

20.2.1 Type tests to be made on a completely assembled Metal Clad switch gear. The type tests may be carried out on a maximum four test specimens followed by grouping of tests as defined in IEC 62271-1.

20.2.2 Following type tests shall be made on representative switchgear incoming & outgoing panels including a complete three pole circuit breaker to be supplied, complete with any disconnecting features, with vent outlets forming part of unit with main connections and bus-bars in presence of two representatives from Design NTDC at an STL approved lab or at any independent lab approved by Design NTDC at the cost & arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the inspectors to prove compliance with the requirements as listed in this specification. The validity of the type tests reports shall be as per type test policy of NTDC.

a) Dielectric tests.
b) Measurement of the resistance of the main complete circuit, Breaker and interrupter in assembled condition and instrument transformers.
c) Temperature-rise test as specified.
d) Verification of the degree of protection of persons against approach to live parts and contact with moving parts.
e) Mechanical operation tests.
f) Extended mechanical endurance test.
g) Verification of making and breaking capacities.
h) Short time withstand and peak withstand current tests on main and earthing circuit.

i) Short-circuit life test as specified for 630A Panel.
j) Electrical endurance test for 2500A Panel.
k) Capacitor bank breaking test.
l) Measurement of contact wear both after short circuit making and breaking tests and short circuit life test.
m) Small inductive test.

However if the circuit breaker had been previously type tested as per requirement of clause 7.10 of this specification then following tests are required to be performed on representative switchgear incoming & outgoing panels in the presence of two representatives from Design NTDC at an independent lab approved by Design NTDC at the cost & arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the inspectors to prove compliance with the requirements as listed in this specification.

a) Dielectric tests.
b) Measurement of the resistance of the main complete circuit, Breaker and interrupter in assembled condition and instrument transformers.
c) Temperature-rise test as specified.
d) Verification of the degree of protection of persons against approach to live parts and contact with moving parts.
e) Short time withstand and peak withstand current tests on main and earthing circuit.

20.2.3 The results of all type tests shall be recorded in type test reports containing data to prove compliance with the specification, and sufficient information shall be included so that the essential parts of the switchgear can be identified. In particular, the following essential information shall include:

- Name of manufacture of switchgear panel.
- Type designation of switchgear panel.
- Rated voltage.
- Rated frequency.
- Rated insulation level.
- Rated normal current.
- Rated short time and peak withstand currents.
- Rated duration of short circuit.
- Rated supply voltage of closing & opening devices and of auxiliary circuit.
- Make, Type, country of origin, Serial No. of circuit breaker.
- Make, Type, country of origin, Serial No. of interrupter.
- Rated short circuit making and breaking currents of circuit breaker.
- Rated operating sequence of circuit breaker.
- Details of operating mechanism and devices employed during tests.
- Rated cable charging breaking current of circuit breaker.
- Rated out of phase making and breaking current of circuit breaker.
- Rated single capacitor bank breaking current of circuit breaker.
- Rated back to back capacitor bank breaking current of circuit breaker.
- Rated capacitor bank inrush making current of circuit breaker.

- Rated back to back capacitor bank inrush making current of circuit breaker.
- Outline drawings and data schedules of switchgear panel.
- Photographs to illustrate the condition of switchgear before and after tests
- Record of test quantities during each test or test duty, as specified in relevant IEC standard.
- Statements of behavior of the switchgear during tests, its condition after test and any parts renewed or reconditioned during the tests.
- The type test reports shall incorporate sufficient information to identify the circuit breaker and general information concerning its supporting structure or metal enclosed unit of which the circuit breaker forms an integral part .Such information shall include but is not restricted to, drawings of breaker general assembly, cross section of the breaker through the axis of arcing contacts, detail of arc control devices, contacts and the operating and coupling mechanism of the breaker, information about the materials used, the outline and other important dimensions such as the travel of moving contact etc. The details of mountings, fixing on insulators, the working details of operating mechanism such as the ampere turns, voltage, cross section of plungers and pole pieces for operating coils.

20.2.4 Type tests carried out on a representative switchgear incoming panel of a manufacturer shall be applicable for bus coupler panel provided the circuit breaker & all allied accessories/equipment to be used shall exactly be of same design, identical in their shape, in their dimensions, in their operating conditions, current & voltage ratings, breaking capacity etc. subject to performance of Short time withstand and peak withstand current test, Dielectric test and temperature rise test as specified on bus coupler panel at an independent lab approved by Design NTDC.

20.2.5 Type tests carried out on a representative switchgear outgoing panel of a manufacturer shall be applicable to industrial, consumer and capacitor bank control switchgear panel(s) provided the circuit breaker & all allied accessories/equipment to be used shall exactly be of same design, identical in their shape, in their dimensions, in their operating conditions, current & voltage ratings, breaker capacity etc. subject to performance of Short time withstand and peak withstand current test, Dielectric test and temperature rise test as specified at an independent lab approved by Design NTDC.

20.2.6 Type testing shall be followed by routine testing as per clause 20.3.1.

20.2.7 **Temperature Rise Test**

The temperature rise test of the main circuit, auxiliary circuits & devices of the panel when carrying rated current shall be according to IEC-62271-200. However, the limits of temperature rise specified in the relevant IEC standard shall be reduced by 10°C to account for higher ambient condition required in this specification.

Note: The quality of the coated contacts shall be such that a continuous layer of coating material remains in the contact area after type tests, otherwise the contacts shall be regarded as "bare". Manufacturer shall specify the thickness of coating during type tests.

20.2.8 **Measurement of the resistance of Main Circuit and Interrupter**

The measurement of resistance shall be carried out as per relevant IEC standard. The resistance of main circuit measured during routine testing shall not exceed 1.2 times the resistance measured before temperature rise test.

20.2.9 **Tolerances on Test Quantities**

Sr. No.	Designation of the Test	Test Quantity	Tolerances
i)	Power frequency voltage test	Test voltage	±1%
ii)	Impulse voltage test	Peak value Front time Time to half value	±3% ±30% ±20%
iii)	Temperature rise test	Test current Frequency Ambient temperature	+2% +2% to -5% +10 to +40°C

20.3 **Routine Tests**

20.3.1 The following routine tests shall be made on all switchgear panels at the manufacturer's works during pre-delivery inspection:

a) Verification of name plate data, marking on CTs, PTs & and other instruments.
b) Visual inspection, verification of dimensions & components used in operating mechanism and other constructional details to verify their conformance to the approved drawings as well as of type tested sample.
c) Checking of interlocking arrangement and other requirements.
d) Inspection of accessories and components to be supplied with the panels.
e) Measurement of the resistance of the main circuit, Breaker and Interrupter.
f) Mechanical operation tests to ensure the proper functioning of the shutter, mechanical interlocks, etc.
g) Tests of auxiliary electrical devices.
h) Verification of the interchangeability of components of the same rating and construction.
i) Power frequency withstand voltage tests on the main circuit.
j) Tests on control and auxiliary circuits. This includes dry short duration power frequency voltage withstand test, inspection of auxiliary & control circuits, verification of conformity to the circuit diagram and wiring, components, functional tests, verification of protection against electric shock and degree of protection (IP Code)
k) Test on bus-bar insulation. The insulated bus-bar selected randomly shall withstand Power frequency for one (01) minute applied between the bus-bar sample and an electrode (metallic foil) effectively covering the outer surface of the insulation but sufficiently far from the ends of the sample of bus-bar.
l) Testing of C.Ts, P.Ts, metering equipment and protection relays via. Test Set.

20.3.2 The acceptance/inspection certificate clearly indicate the performance of above tests during pre-delivery inspection/testing and test results shall be submitted to the Purchaser.

21.0 SPARE PARTS

The requirements of spare parts to be supplied against an order shall be clearly indicated by the purchaser in the schedule of prices keeping in view the available stock of spares. A list of commonly required spares is given below for guidance of purchaser for each group of twenty (20) switchgear panels of same characteristics and ratings

a) Complete trolley 1 Nos.
b) Current transformer 3 Nos.
c) Voltage transformer 3 Nos.
d) Vacuum bottles 3 Nos.
e) Complete insulation housing
f) Busbar spouts with contacts, 1 Set.
g) Bus-bar support insulators 1 Set
h) Set of trip coils (DC & AC) as applicable.
i) Operating mechanism complete 1 No.
j) Charging motor 1 No.
k) Overcurrent relay each type used 1 No.
l) Supervision relay, 1 No.
m) Socapex 1No.
n) Test Block 1No.
o) Hooter 1 No.
p) Set of signaling Lamps, 1 No.
q) Ammeter with spare parts 2 No.
r) Voltmeter 1 No.
s) Power Quality Analyzer 1 No.
t) Power factor meter 1 No.
u) Terminal blocks 10 Nos.
v) Auxiliary relays 02 Nos.
w) Test Plug for Testing of Protection Relays 2 No.
x) Set of insulating sheets 3 Sets used for insulating, covering and partitioning.

22.0 DRAWINGS AND DESCRIPTIVE DATA

22.1 Data to be provided by Purchaser/End User

Following data/requirement shall be provided by the purchaser/end-user.

a) Type of Panel with rating.
b) Requirement of Earthing switch and Power Quality Analyzer.
c) Any specific requirement of tools & accessories other than clause 5.12.
d) Requirement for relays as per clause 12.3.3.
e) Requirement of spare parts.

f) Any other special requirement.

22.2 **Drawings & Data to be submitted with the bid**

22.2.1 Overall assembly drawing showing front, back side and plan views with doors closed and open of switchgear panel. Sufficient cross sections and parts views shall be indicated to clearly show all the equipment. All leading dimensions and clearances shall also be indicated.

22.2.2 Supply record of offered type, current & voltage rating of switchgear panels for last five years on the following format:

Sr. No.	Contract/Purchase Order No. & date	Quantity	Current/Voltage rating	Delivery period	Client Address/ Phone/ Fax No./ E-mail, etc.

22.2.3 The schedule of technical data completely filled-in attached hereto. The word indicating "as per specification/standard", "equivalent" will not be acceptable.

22.2.4 Manufacturer's catalogues/drawings as required in the schedule of technical data.

22.2.5 Non-submission of completely filled - in schedule of technical data and supply record on the above format or submission of incomplete information/data as mentioned above with the bid, may render the bid non-responsive.

22.3 **Drawings & Data to be submitted for approval**

The supplier/manufacturer shall be required to furnish the following for approval:

a) The schedule of technical data completely filled-in attached hereto. The word indicating "as per specification/standard", 'equivalent' will not be acceptable.
b) List of all the components/equipment, their manufacturer's name & country of origin used in the manufacture of switchgear panels.
c) Complete wiring and schematic diagram.
d) Overall assembly drawing showing front, side and plan views. Sufficient cross-sections and part views shall be included to clearly indicate all the equipment and insulation barrier plates. All leading dimensions and clearances shall be indicated. The sizes, and lengths of all sheets, angles, and shapes shall be provided.
e) The drawings of support insulators, bus-bars, cable entry plates, lifting eyes, hinges, locking and sealing facilities and handles etc.
f) The equipment used in the CB and in their operating mechanism, etc.
g) The drawing showing detailed physical arrangements and connection of the load break switch.
h) Detail of Earthing Arrangement.

23.0 **PACKING AND TRANSPORTATION**

The switchgear panels and all allied accessories shall be supplied in packing suitable for transport by rail/road and sea as per international practice. Special precaution may be essential for protection

of insulation during transport to prevent moisture absorption due, for instance, to rain, snow or condensation for one year.

24.0 ATTACHMENTS

Following data sheets and drawings are attached herewith:

a) Schedule of Technical Data
b) Drawings
   i) PDW/DF-297
   ii) PDW/DF-299 A
   iii) PDW/DF-299 B
   iv) PDW/DF-300
   v) PDW/DF-423
   vi) PDW/DF-444
   vii) PDW/DF-445
   viii) PDW/DF-446
   ix) PDW/DF-447
   x) PDW/TE-580
   xi) PDW/TE-581
   xii) PDW/TE-582
   xiii) PDW/TE-1331
   xiv) PDW/TE-1630
   xv) PDW/TS-2010
   xvi) PDW/TS-4932

****

DATE OF APPROVAL:			
APPROVED BY:			
Mr. Naeem Hassan	Mr. Ashraf Elahi	Mr. Raja Liaqat	Mr. Rao Afzal
CE (S.S.D) NTDC (Secretary)	**GM (D&E) NTDC (Member)**	**GM (A.M) North NTDC (Member)**	**GM (P.D) North NTDC (Member)**
Qazi Mir Ahmed			
GM(TECH) NTDC (Convener)			

SCHEDULE OF TECHNICAL DATA
FOR 11kV METAL-CLAD SWITCHGEAR PANELS
(NTDC SPECIFICATION P-44:2018)

A.	GENERAL		Proposed Data	Deviation from P-44:2018 (If any)
1.	Switchgear Manufacturer's name			
2.	Switchgear Manufacturer's address			
3.	Type test reports attached	YES/NO		
4.	Type/designation of switchgear panel on which following type tests performed.			
5.	**Details of Type Test if performed. (Attach Type test report)**	**Date of Test**	**Name of Lab.**	
	- Lightning Impulse Voltage Withstand test.			
	- Power frequency withstand Voltage test.			
	- Measurement of the resistance of the main circuit.			
	- Temperature-rise test.			
	- Short time and peak withstand current tests.			
	- Verification of the degree of protection.			
	- Verification of making and breaking capacities.			
	- Mechanical operation tests.			
	- Tests on non-metallic partitions and shutters.			
	- Internal arcing test.			
	- Short-circuit life test as specified			
	- Capacitor bank breaking test.			
	- Measurement of contact wear both after short circuit making and breaking tests and short circuit life test.			
	- Mechanical endurance test as specified.			
B.	**RATINGS OF SWITCHGEAR PANEL**			
1.	Nominal Voltage	kV		
2.	Rated Voltage	kV		
3.	Rated Current	A		

4.	Rated short-circuit withstand current for main and earthing circuit	kA		
5.	Rated peak withstand current for main and earthing circuit	kA		
6.	Lightning Impulse Withstand Voltage.	kV		
7.	Power frequency withstand Voltage.	kV		
8.	Phase to phase clearance	Mm		
9.	Phase to ground clearance	Mm		
10.	Thickness of insulation sheet between phases	Mm		
11.	Material of insulation sheet	Mm		
12.	Size of control cable used in voltage circuit	mm^2		
13.	Size of cable used in current circuit.	mm^2		
14.	Whether the switchgear is completely covered on both sides?	YES/NO		
15.	Whether fire retardant pipes are provided for connection to adjacent panels on both sides?	YES/NO		
16.	Whether fiberglass sheet having min. thickness of 4mm for covering the bus-bar chamber on both sides of each panel has been installed?	YES/NO		
17.	Whether control cables run through steel channels with removable cover?	YES/NO		
18.	Whether color coding of control cables as per clause 14.2 is used?	YES/NO		

B.	**CIRCUIT BREAKER**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name. (Attach Manufacturer's catalogue with the bid)			
2.	Manufacturer's address.			
3.	Type/designation			
4.	Country of origin			
5.	Suitability for 3-phase operation and rapid reclosing for outgoing feeders			
6.	Current rating of circuit breaker on which type tests were performed.	A		
7.	Mass of complete circuit breaker			
8.	No. of breaks in series per pole			
9.	No. of poles			
10.	No. of close open operations possible with the stored energy			

11.	Minimum clearance in air between poles				
12.	Minimum clearance in air between poles to earth				
13.	Type Tests (Copy of type test reports attached)		YES/NO		
14.	Type/ordering code of CB installed in switchgear panel on which type tests performed.				
15.	Type/designation of interrupter installed in CB on which type tests performed.				
16.	**Details of following Type Test if performed. (Attach Type test report)**		**Date of Test**	**Name of Lab.**	
	-	Dielectric tests			
	-	Short time withstand and peak withstand current tests			
	-	Extended mechanical endurance test at ambient air temperature			
	-	Short circuit current making & breaking tests			
	-	Capacitor Bank Breaking and Capacitive Current Switching Tests			
	-	Short circuit life test			
	-	Measurement of resistance of interrupter in assembled condition			
	-	Electrical endurance test			
17.	Rated voltage		kV		
18.	Lightening impulse withstand voltage		kV		
19.	Power frequency withstand voltage		kV		
20.	Rated frequency		Hz		
21.	Circuit Breaker Class				
	-	w.r.t Mechanical Endurance			
	-	w.r.t Electrical Endurance			
	-	w.r.t Capacitive Current Breaking			
	-	w.r.t Connection to cables			
22.	Rated capacitor bank breaking current		kA		
23.	Rated short circuit breaking current		kA		
24.	Percentage DC component		%		
25.	Rated short time withstand current		kA		
26.	Rated duration of short circuit		Sec.		

27	Rated short circuit making current		kA		
28.	Rated peak withstand current		kA		
29.	First pole to clear factor				
30.	Rated transient recovery voltage for terminal faults		kV		
31.	Rated operating sequence				
32.	Break time				
33.	Dead time				
34.	Opening time				
35.	Closing time				
36.	Spring charging time				
37.	Arcing time				
38.	Close-Open time				
39.	Time between two operations necessary to restore the initial conditions and/or to prevent undue heating of parts of circuit breaker, t.		Seconds		
40.	Current capability of offered circuit breaker at 20 °C (Attach Load Current Vs Ambient Temp. curve)				
41.	Temperature rise at normal rated current				
	-	Contacts	°C		
	-	Terminals	°C		
	-	Other metal parts	°C		
42.	Resistance of main circuit of CB.		μΩ		
43.	Guaranteed mechanical life of circuit breaker and operating mechanism and category assigned for mechanical test				
44.	No. of mechanical operating cycles the circuit breaker is capable to performing without the need for mechanical adjustments				
45.	No. of opening operations the circuit breaker is capable to perform without maintenance at:				
	-	Rated normal current			
	-	10 % rated breaking current			
	-	30 % rated breaking current			
	-	60 % rated breaking current			
	-	100 % rated breaking current			

C.	INTERRUPTER		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & address. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation			
3.	Country of origin			
4.	Type tests reports attached			
5.	Type of interrupter installed in CB on which following type tests were performed.			
6.	Rated voltage			
7.	Rated normal current			
8.	Rated short circuit breaking current			
9.	Rated duration of short circuit			
10.	Rated single capacitor bank breaking current			
11.	Lightening Impulse withstand voltage			
12.	Power frequency withstand voltage			
13.	Type of circuit breaker on which the offered interrupter was type tested			
14.	Resistance of interrupter on which type tests were performed (attach document)			
15.	Dimensions (Drawing attached)			
16.	Interrupter weight.			
17.	Contact Force			
18.	Mechanical Life			
19.	Electrical Life at rated normal current			
20.	Interrupter contact material			

D.	OPERATING MECHANISM		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name and country of origin of trip coil			
2.	Manufacturer's name and country of origin of closing/opening coil			
3.	Rated voltage of closing coil (Max./Min.)	V		
4.	Rated voltage of DC trip coil (Max./Min.)	V		
5.	Rated power consumption of Closing coil	W		
6.	Rated power consumption of Trip coil	W		

7.	Motor for spring charge mechanism:			
	- Manufacturer's name and country of origin			
	- Rated voltage	V		
	- Rated power consumption	W		
8.	Time required for motor to recharge the closing spring			
9.	Type of auxiliary switches			
10.	Total Nos. of Auxiliary contacts			
11.	Total number of Auxiliary contacts			
12.	Number of spare Auxiliary contacts			
13.	Whether lockout preventing closing facility is provided?			
14.	Whether anti-pumping feature has been provided?			

E.	**CB ISOLATING CONTACTS**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Material			
3.	Whether isolating contacts are silver-plated?			
4.	Whether type testing of offered CB was done with the same make & type of isolating contacts?			
5.	Dimensions of isolating contact (Attach drawings)			
6.	Whether isolating contacts are clip type for outgoing panel? (Attach drawing)	YES/NO		
7.	Whether isolating contacts are tulip type for incoming panel? (Attach drawing)	YES/NO		

F.	**LOAD BREAK SWITCH**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name and country of origin (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation			
3.	Type tests reports attached	YES/NO		
4.	Rated voltage	kV		
5.	Rated current	A		
6.	Electrical Endurance class			

7.	Mechanical Endurance class			
8.	Rated short time and peak withstand current	kA		
9.	Rated short circuit making current	kA		
10.	Rated lightening impulse withstand voltage:	kV		
11.	Rated power frequency withstand voltage:	kV		
12.	No. of positions of load break switch.	Nos.		
13.	Type of HRC fuse used in LBS			
14.	HRC fuse Manufacturer's name & country of origin (Attach Manufacturer's catalogue with the bid)			
15.	Type/designation of HRC fuse			
16.	Country of origin of HRC fuse			
17.	Rated voltage of HRC fuse	kV		
18.	Rated current of HRC fuse	A		

G.	**EARTHING SWITCH**		**Proposed Data**	**Deviation from P-44:2018**
1.	Manufacturer's name and country of origin (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation			
3.	Type tests reports attached	YES/NO		
4.	Rated voltage	kV		
6.	Rated short time and peak withstand time current	kA		
7.	Rated short circuit making current	kA		
8.	Electrical Endurance class			
9.	Mechanical Endurance class			
H.	**PANEL ENCLOSURE**		**Proposed Data**	**Deviation from P-44:2018**
1.	Thickness of sheet			
2.	Material of sheet			
3.	Degree of protection			
4.	Dimensions of panel (Attach drawings)			
5.	Whether cable entry gland/clamp plates are removable?			
6.	Whether spring loaded type explosion vents provided on the top of panel?			
7.	Material of shutter			

I.	**BUSBARS**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Material			
3.	Size of main bus-bars			
4.	Size of dropper bus-bars			
5.	Electrical conductivity of bus bar			
6.	Resistance of complete main circuit with CTs at 20 °C before temperature rise test (R/Y/B)	μΩ		
7.	Resistance of complete main circuit without CTs at 20 °C before temperature rise test (R/Y/B)	μΩ		
8.	Whether bus bars are tin plated?	YES/NO		
9.	Phase to phase clearance of main bus-bars			
10.	Phase to phase clearance of dropper bus-bars			
11	Distance of bus bar from front of the panel			

J.	**BUS BAR INSULATION**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
4.	Type tests reports attached	YES/NO		
5.	Material of insulation sleeves			
6.	Does the insulation provided on bus bars have properties of non-corrosive, non-tracking and is flame retardant?	YES/NO		
7.	Whether bus bar at joints are provided with covers?			
8.	Material of insulation covers on joints			
9.	Color of insulation			
10.	Impulse withstand voltage			
12.	Continuous voltage withstand capability			

K.	BUSBAR SUPPORT INSULATOR		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of bus-bar support insulator			
3.	Type Tests (Copy of type test reports attached)	YES/NO		
4.	Material of insulator			
5.	Creepage distance	Mm		
6.	Rated lightening impulse withstand voltage	kV		
7.	Rated one-minute power frequency withstand voltage	kV		
8.	Failing load bending	KN		
9.	Dimensions (Attach drawing)			

L.	CAST RESIN SPOUTS		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation			
3.	Type tests reports attached	YES/NO		
4.	Material of spouts			
5.	Short time withstand current			
6.	Rated lightning impulse withstand voltage			
7.	Rated power frequency withstand voltage			
8.	Dimensions (Attach drawing)			

M.	EARTHING		Proposed Data	Deviation from P-44:2018 (If any)
1.	Dimensions of common earthing strip			
2.	Size of flexible earthing parts of hinged parts			
3.	Size of earthing terminal			
4.	Short time withstand current for earthing circuits			
5.	Peak withstand current			
6.	Whether earthing strip at joints is tin plated?	YES/NO		

N.	MINIATURE CIRCUIT BREAKER		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of MCBs			
3.	Type Tests (Copy of type test reports attached)	YES/NO		
4.	Rated voltage (AC/DC)			
5.	Rated normal current			
6.	Rated breaking current			
7.	Operating time at rated breaking current			
8.	Whether each MCB is provided with two auxiliary contacts.			

O.	INSTRUMENTS (Power Quality Analyzer Ammeter, Voltmeter & Power Factor meter)		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation/ordering code of Ammeter.			
3.	Type/designation/ordering code of Voltmeter.			
4.	Type/designation/ordering code of Power Factor meter.			
5.	Type/designation/ordering code of Power Quality Analyzer			
6.	Type Tests (Copy of type test reports attached)	YES/NO		
7.	Full scale range of Ammeter			
8.	Scale range of Voltmeter			
9.	Scale range of Power Factor Meter			
10.	Accuracy class of Ammeter			
11.	Accuracy class of Voltmeter			
12.	Accuracy class of Power Factor Meter			
13.	Accuracy class of Power Quality Analyzer			
14.	Dimensions of meters.			
15.	Whether separate scale plates for each CT ratio is provided?	YES/NO		
16.	Whether name plate data/marking & symbols is printed on the meters?	YES/NO		

P.	**OVERCURRENT & EARTH FAULT RELAY (with built-in two step capacitor unbalance detection protection for Capacitor protection, wherever applicable)**		**Proposed Data**	**Deviation from P-44:2018**
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of over current relay along with ordering code & detail ordering sheet)			
3.	Type Tests (copy of type test reports attached)	YES/NO		
4.	Type of characteristics for phase O/C & E/F element			
5.	Type of characteristics for Sensitive E/F element **(for applicable cases only)**			
6.	No. of elements			
7.	CT Inputs (1A/5A)			
8.	Setting range of over-current element			
9.	Setting range of earth Fault element			
10.	Setting range of Phase & E/F instantaneous element			
11.	Setting range of Sensitive Earth Fault Protection element **(for applicable cases only)**			
12	Setting range of instantaneous Sensitive Earth Fault Protection element **(for applicable cases only)**			
13.	Operating voltage	V		
14.	No. of Binary input/output contacts i.Binary Inputs ii.Binary Outputs			
15.	Continuous contact rating.	VA		
16.	Make/break contact rating	VA		
17.	Front & Rear Ports			
18.	Dimensions (Attach drawings)			
19.	Whether the offered relay is approved by NTDC System protection department?	YES/NO		
20.	Detail of Fiber Optic Interface IEC61850 compliant for Remote Communication/SAS			

Q.	OVER/UNDER VOLTAGE RELAY		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of over current relay along with ordering code & detail ordering sheet)			
3.	Type Tests (copy of type test reports attached)	YES/NO		
4.	Type of characteristics			
5.	VT input			
6.	No. of elements			
7.	Setting range of Over voltage element			
8.	Setting range of Under Voltage element			
9.	Is VT Fuse Failure element available?	YES/NO		
10.	No. of Binary input/output contacts i.Binary Inputs ii.Binary Outputs			
11.	Continuous contact rating.	VA		
12.	Make/break contact rating	VA		
13.	Front & Rear Ports			
14.	Dimensions (Attach drawings)			
15.	Whether the offered relay is approved by NTDC System protection department?	YES/NO		
R.	**DC TRIP CIRCUIT SUPERVISION RELAY**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid).			
2.	Type/designation of DC Supervision Relay			
3.	Type Tests (Copy of type test reports attached)	YES/NO		
4.	Monitors full trip circuit with CB open and close.			
5.	Rated Voltage			
6.	Operating voltage range			
7.	a) Operating time.			
	b) Resetting time.			
	c) Time delayed drop off period.			
8.	No. of contacts.			

9.	Continuous contact rating	VA		
10.	Make/break contact rating	VA		
11.	Dimensions (Attach drawings)			
12.	Whether the offered relay is approved by NTDC System protection department.	YES/NO		

S.	**TRIPPING RELAYS.**		**Proposed Data**	**Deviation from P-44:2018 (if any)**
1.	a) Manufacturer.			
	b) Country of Manufacture.			
	a)Type			
2.	Ordering code along with ordering sheet			
3.	Nominal operating voltage.			
4.	Minimum Operating voltage.			
5.	Contact Mechanism Reset (Hand / Electrical).			
6.	Operation indicator (Hand Reset).			
7.	Operating time at nominal voltage.			
8.	No. of Contacts a)NO b)NC			
9.	Contact rating:			
	a)Make and carry continuously. •AC •DC			
	b)Make and carry for 3 secs. •AC •DC			
	c)Break •resistive watts. •Inductive (L/R=0.04sec) VA			
10.	Thermal withstand capacity.			
11.	Reset mechanism.			
12.	Dimensions (Attach drawings)			
13.	Whether the offered relay is approved by NTDC System protection department.	YES/NO		

T.	CURRENT TRANSFORMER		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of offered current transformer			
3.	Type Tests (copy of type test reports attached).	YES/NO		
4.	Rated voltage (Um), rms.	kV		
5.	Nominal voltage, rms.	kV		
6.	Rated Frequency.	Hz		
7.	Rated normal primary current.	A		
8.	Rated Secondary current.	A		
9.	Rated continuous Thermal current, Itch,	%		
10.	Lightning Impulse voltage (Primary winding).	kV		
11.	Power frequency Voltage (Primary winding).	kV		
12.	Power frequency Voltage (secondary winding).	kV		
13.	Insulation Class			
14.	Rated duration of short circuit.	Sec.		
15.	Temperature rise.	°C		
16.	Max. Temp. withstand capability	°C		
17.	Accuracy limit factor.			
18.	Instrument Security Factor.			
19.	Inter Turn Insulation level.	kV		
20.	Resistance of primary winding at 20°C ambient temp.			
21.	Resistance of secondary winding at 20°C ambient temp.:			
	a. Measuring Core 1.	mΩ		
	b. Protective Core 2.	mΩ		
22.	Rated Secondary Output, VA:			
	a. Measuring Core 1.	VA		
	b. Protective Core 2.	VA		
23.	Accuracy Class:			
	a. Measuring Core.	A		
	b. Protective Core.	A		
24.	Short time **Thermal (Ith)/dynamic(Idyn)** current rating.	kA		
25.	Partial Discharge at 1.2Um/ 1.2 Um/$\sqrt{3}$.	PC		

U.	VOLTAGE TRANSFORMER		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of offered voltage transformer.			
3.	Type Tests (Copy of type test reports attached).	YES/NO		
4.	Rated Primary Voltage, Um, kV, rms.	kV		
5.	Rated Secondary Voltage, Um, V, rms.	V		
6.	Nominal Primary Voltage, Un, kV,rms.	kV		
7.	Rated Secondary Voltage, Um, kV, rms.	V		
8.	Rated Frequency.	Hz		
9.	Rated Secondary Output:			
	- Measuring winding.	VA		
	- Protective winding.	VA		
10.	Accuracy Class:			
	- Measuring winding.			
	- Protective winding.			
11.	Rated Voltage Factor:			
	- Continuous duty.			
	- 30 second duty.			
12.	Temp. Rise at 1.2 times the rated primary voltage.	°C		
13.	Temperature Rise under short circuit condition.	°C		
14.	Lightning Impulse withstand voltage (Primary winding).	kV		
15.	Power freq. withstand Voltage (Primary winding).	kV		
16.	Power freq. withstand Voltage (secondary winding).	kV		
17.	Resistance of primary winding at 20°C ambient temp.			
20.	Resistance of secondary winding at 20°C ambient temp.			
21.	Partial Discharge at Um/1.2Um/1.2Um/√3.	pC		
22.	Short circuit withstand capability.	Sec.		
23.	Permissible secondary short circuit current.			
24.	Details of deviations of the offered CTs from NTDC specification amended to date (attach details if any).			

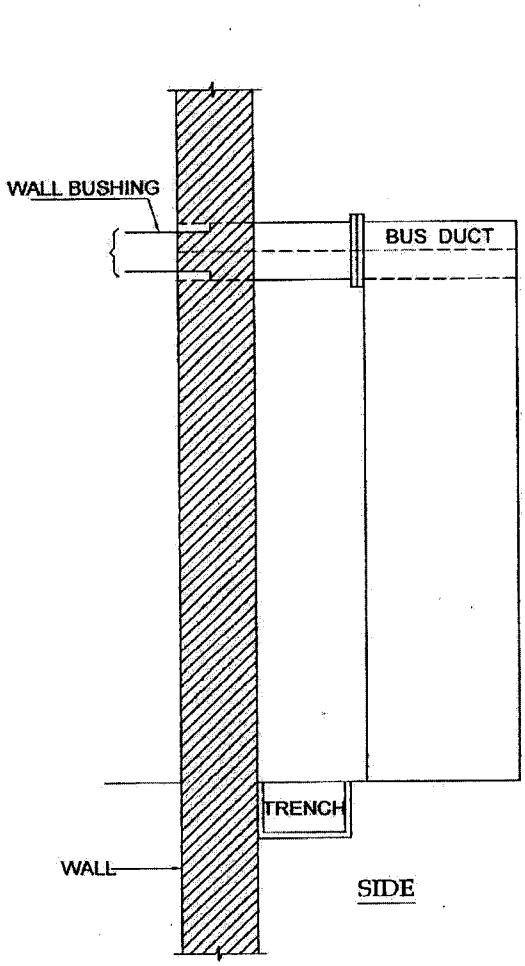
V.	SURGE ARRESTOR		Proposed Data	Deviation from P-44:2018 (If any)
1.	Manufacturer's name & country of origin. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of surge arrestor.			
3.	ZnO Block 's manufacturer name & address.			
4.	Type Tests (Copy of type test reports attached)	YES/NO		
5.	Highest System voltage, Um.	kV, rms		
6.	Nominal System voltage, Un.	kV, rms		
7.	Arrester min. Rated Voltage, Ur.	kV, rms		
8.	Rated Frequency	Hz		
9.	Nominal discharge current, In	kA, peak		
10.	Material of housing (Porcelain/Polymer)			
11.	Continuous operating voltage (Uc), kV.			
12.	Temporary over voltage (TOV), **1s /10 s**.	kVrms		
13.	Line discharge class			
14.	Short circuit withstand current, (0.2 s)	kAsym.		
15.	Pressure relief class			
16.	High Current 4/10 µs Impulse withstand	kApeak		
17.	Switching Current Impulse Withstand (Upper value).	A		
18.	Maximum Residual Voltage at 10kA Steep Impulse current wave of 1/20µs.	kV		
19.	1.2/50 µs Lightning Impulse Withstand Voltage	kVpeak		
20.	Power frequency withstand voltage for one minute	kV		
21.	Internal partial discharge at 1.05 times continuous operating voltage	pC		
22.	Maximum Residual voltage at lightning impulse current waves of 8/20 µs.			
	- 5 kA.	kVpeak.		
	- 10 kA.	kVpeak.		
	- 20 kA.	kVpeak.		
23.	Max. Residual Voltage at Switching Impulse current wave of 30/60 µs:			
	- 500 A.	kVpeak.		
	- 1000 A.	kVpeak.		
	- 2000 A.	kVpeak.		
24.	Energy discharge capability (2 impulses).			
	- Thermal	kJ/kV (Ur).		
	- Impulse	kJ/kV (Ur).		

W.	ENERGY METER	Proposed Data		Deviation from P-44:2018 (If any)
1.	Manufacturer's name			
2.	Manufacturer's address. (Attach Manufacturer's catalogue with the bid)			
3.	Type/designation/Model No. of offered meter.			
4.	Country of origin.			
5.	Accuracy class (Active/Reactive) of Energy Meter on which type tests were performed.			
6.	Type/designation of Energy meter on which type tests were performed.			
7.	Capability of offered energy meter to record:			
	- Active Energy Export	YES/NO		
	- Reactive Energy Export	YES/NO		
	- Active Energy Import	YES/NO		
	- Reactive Energy Import	YES/NO		
	- Apparent Energy	YES/NO		
	- Maximum Demand of Active Energy	YES/NO		
	- Maximum Demand of Reactive Energy	YES/NO		
	- Maximum Demand of Apparent Energy	YES/NO		
	- Active Energy	YES/NO		
	- Reactive Energy	YES/NO		
	- Apparent Energy	YES/NO		
8.	No. of phases/wires.	Nos.		
9.	Reference Voltage (U)	Volts		
10.	Reference Temperature.	°C		
11	Reference frequency (f)	Hz		
12.	Rated current, In.	Amp		
13.	Maximum current, Imax.	Amp		
14.	Whether meter operates continuously at 1.2 In?	YES/NO		
15.	Sampling rate			
16.	Whether the arrangements as required are available on the front cover?	YES/NO		
17.	Type of display.	LCD/LEDs		
18.	No. of digits of display.	Nos.		
19.	Size of digits of display (H x W)	mm		
20.	Minimum retention period of back up non-volatile memory.	Months		
21.	Type of Memory.			
22.	Memory storage capacity of display unit.	Bytes		

23.		Memory storage capacity of each register.	Bytes		
24.		Memory capacity for load profile.	Bytes		
25.		Total memory storage capacity of all register.	Bytes		
26.		Overall memory capacity for energy meter.	Bytes		
27.		Minimum retention period of display unit.			
28.		Minimum retention period of registers.			
29.		Battery life for display unit.			
30.		Whether facility for activating the display is provided on the front of the meter?	YES/NO		
31.		Whether display unit is reactivated in case failure of main/auxiliary supply?	YES/NO		
32.		Whether display unit is able to record & display data for a minimum period of 120 days corresponding to max. current at reference voltage and unity power factor?			
33.		Whether following data/information is displayed on with date & time stamped?			
	-	Date and time	YES/NO		
	-	CT & PT ratio	YES/NO		
	-	Phase/Line voltages	YES/NO		
	-	Phase/Line currents	YES/NO		
	-	Active energies import and export (present & preceding month), KWH.	YES/NO		
	-	Reactive energies import and export (present & preceding month), KVARH.	YES/NO		
	-	Apparent energies import and export (present & preceding month), KVAH.	YES/NO		
	-	Max. Demand of Active energies import and export (present & preceding month), KW.	YES/NO		
	-	Max. Demand of Reactive energies import and export (present & preceding month), KVAR.	YES/NO		
	-	Max. Demand Apparent energies import and export (present & preceding month), KVA.	YES/NO		
	-	Power factor, PF.	YES/NO		
	-	Frequency, Hz.	YES/NO		
	-	Last Max. Demand reset	YES/NO		
	-	Total No. of Max. Demands resets	YES/NO		
	-	Meter serial No.	YES/NO		
	-	Power Quadrant Indicator.	YES/NO		
	-	Pulse Output for field testing of meter	YES/NO		
	-	Error code	YES/NO		

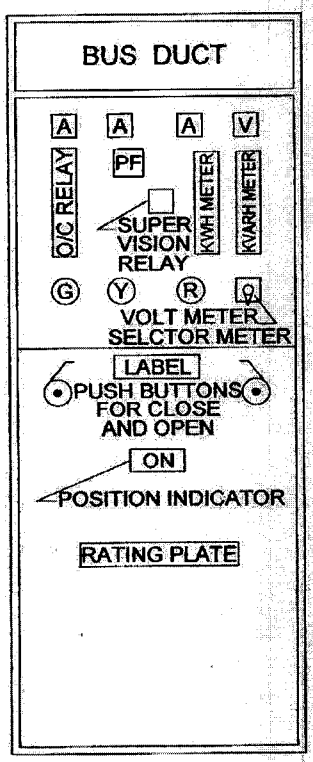
34.	Pulse outputs for remote metering:-			
	- Type of outputs.			
	- VA burden of outputs.			
	- No. of output terminals.			
	- Number of pulse outputs			
35.	Whether flashing LED indicators are provided on the meter for accuracy measurement?	YES/NO		
36.	Whether optical probes along with software on CD shall be supplied as mentioned in NTDC Spec. P- 202?	YES/NO		
37.	Normal operating voltage range	Volts		
38.	Limit range of voltage operation	Volts		
39.	Minimum starting current	mA		
40.	Initial start-up time	ms.		
41.	No. of Tariffs	Nos.		
42.	Type of Tariffs			
43.	No. of registers	Nos.		
44.	Whether meter record the all events with Date and Time Stamped as mentioned in NTDC Specification P-202:2012?	YES/NO		
45.	Type of metrology indicator (visible light/IR)			
46.	Whether energy meter have security features with Date and Time Stamped as mentioned in NTDC Specification P-202:2012?	YES/NO		
47.	EMC Electrostatic discharge.	kV		
48.	VF magnetic field withstand level.	V/m		
49.	Whether meter have upgraded option.	YES/NO		
50.	Whether offered energy meter comply with DLMS/COSEM/SCADA protocols.	YES/NO		
51.	Dimensions of energy meter (attach drawing)			
52.	Weight of energy meter.	Kg.		
X.	**TERMINAL BLOCKS & CABLES**		**Proposed Data**	**Deviation from P-44:2018 (If any)**
1.	Manufacturer's name & address. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of Terminal blocks			
3.	Country of origin			
4.	Type Tests (Copy of type test reports attached)	YES/NO		
5.	Current carrying capacity			
6.	Size of terminal block used in voltage circuit.			
7.	Size of terminal block used in current circuit.			
8.	No. of spare terminal blocks provided			

9.	Size of cable used in voltage circuit.			
10.	Size of cable used in current circuit.			
11.	Type of cable identification.			
12.	Color of cable used in red phase			
13.	Color of cable used in yellow phase			
14.	Color of cable used in blue phase			
15.	Color of cable used in neutral			
Y.	**DIMENSIONS AND WEIGHTS**		**Proposed Data**	**Deviation from P-44:2018 (if any)**
1.	Dimensions of circuit breaker (attach drawing).			
2.	Dimensions of complete panel (attach drawing).			
3.	Weight of circuit breaker.			
4.	Weight of complete panel.			



SIDE

STANDARD FLANGE



ELEVATION

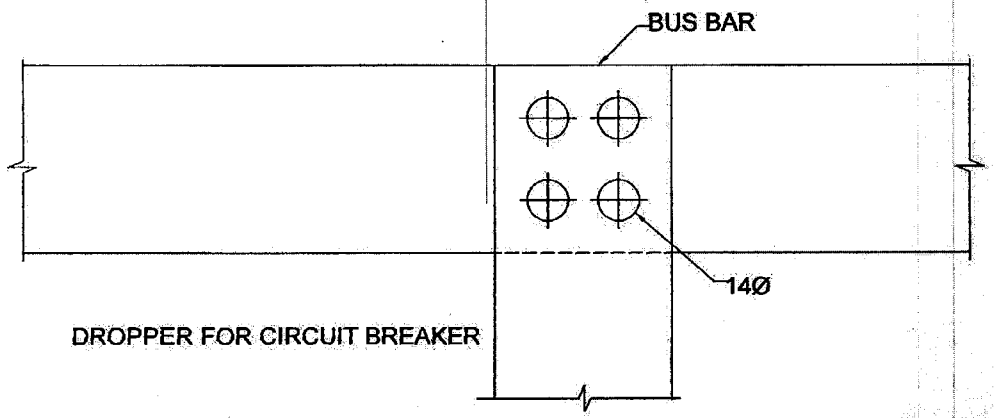
NOTE:-

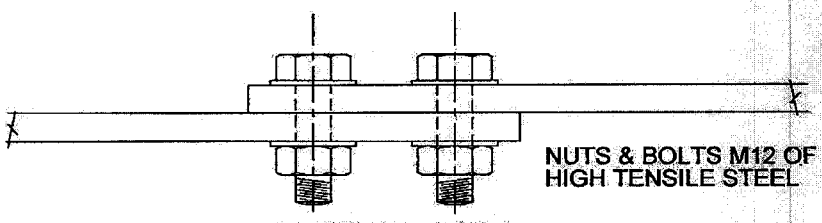
SUPERVISION RELAY AND INDICATING LAMP 'Y' ONLY FOR 25KA PANELS.

THIS DRAWING SUPERSEDES DWG.NO.EW/DF-425 DATED 04-9-68

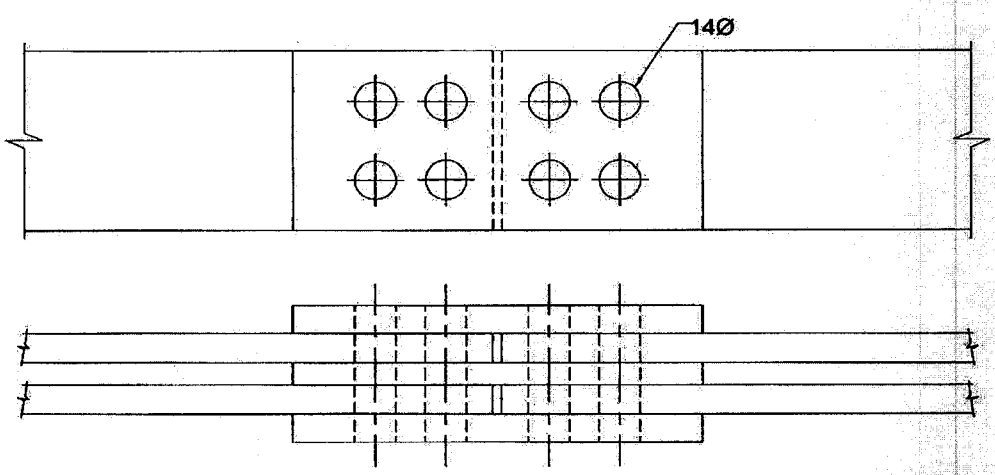
NATIONAL TRANSMISSION AND DISPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	A.HASSAN	sd.	**BUS DUCT FOR 11KV INCOMING PANEL**
CHECKED	GHULAM RASUL	sd.	
JUNIOR ENGINEER			
SENIOR ENGINEER	MUHAMMAD RAFIQUE	sd.	
DIRECTOR	SHAMS-UL-HAQ	sd.	SCALE :- N.T.S / DATE :- 5 - 10 - 2011
CHIEF ENGINEER	JAVID AKHTAR		DWG. NO. PDW/DF - 300

REVISIONS	REVISED ON:-
1.TITLE CHANGED WAPDA TO NTDC	PERVEZ IQBAL ADDL.CHIEF ENGINEER DESIGN S&R





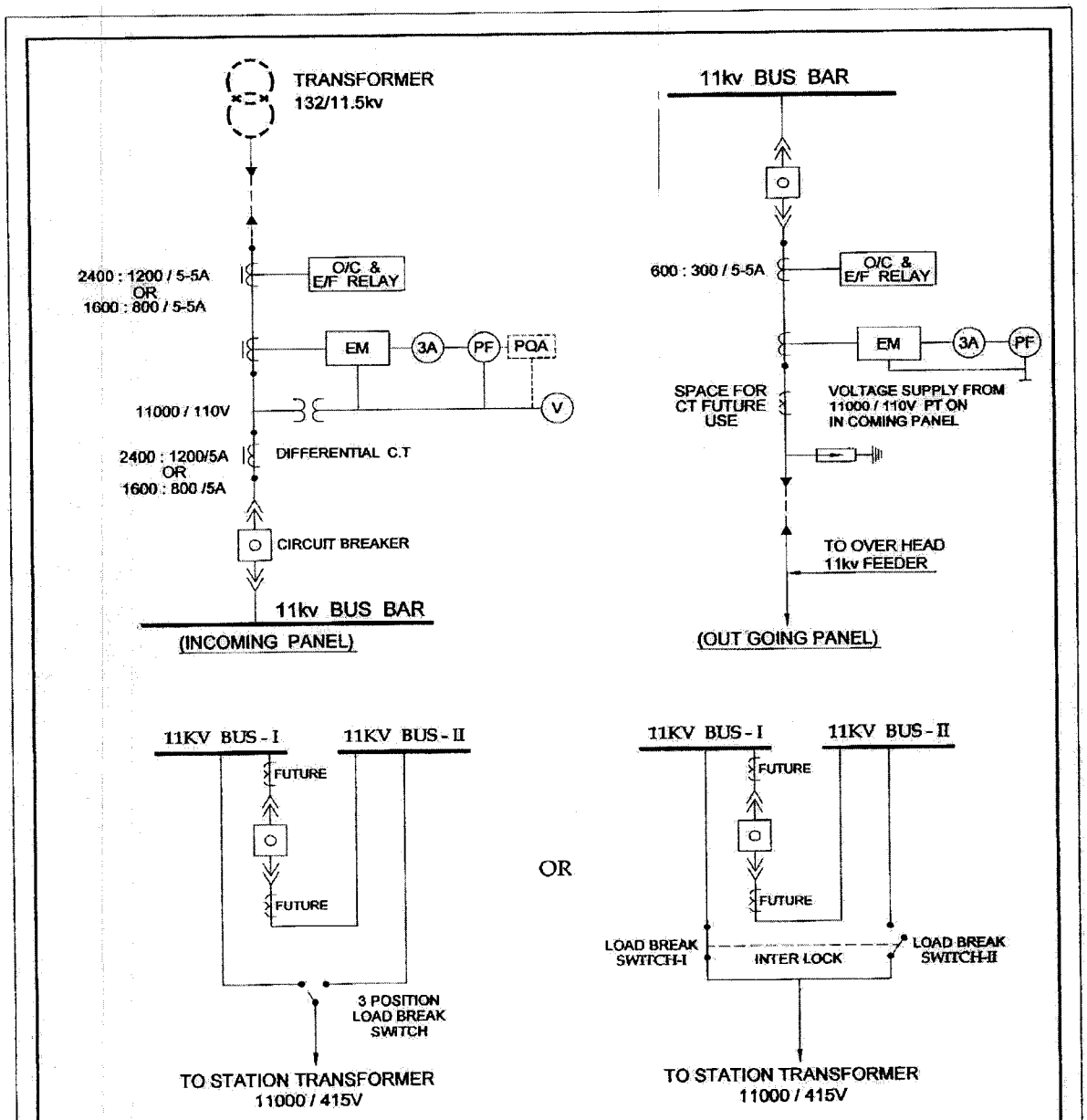
'A' TYPICAL JOINT



BUS BAR JOINTING

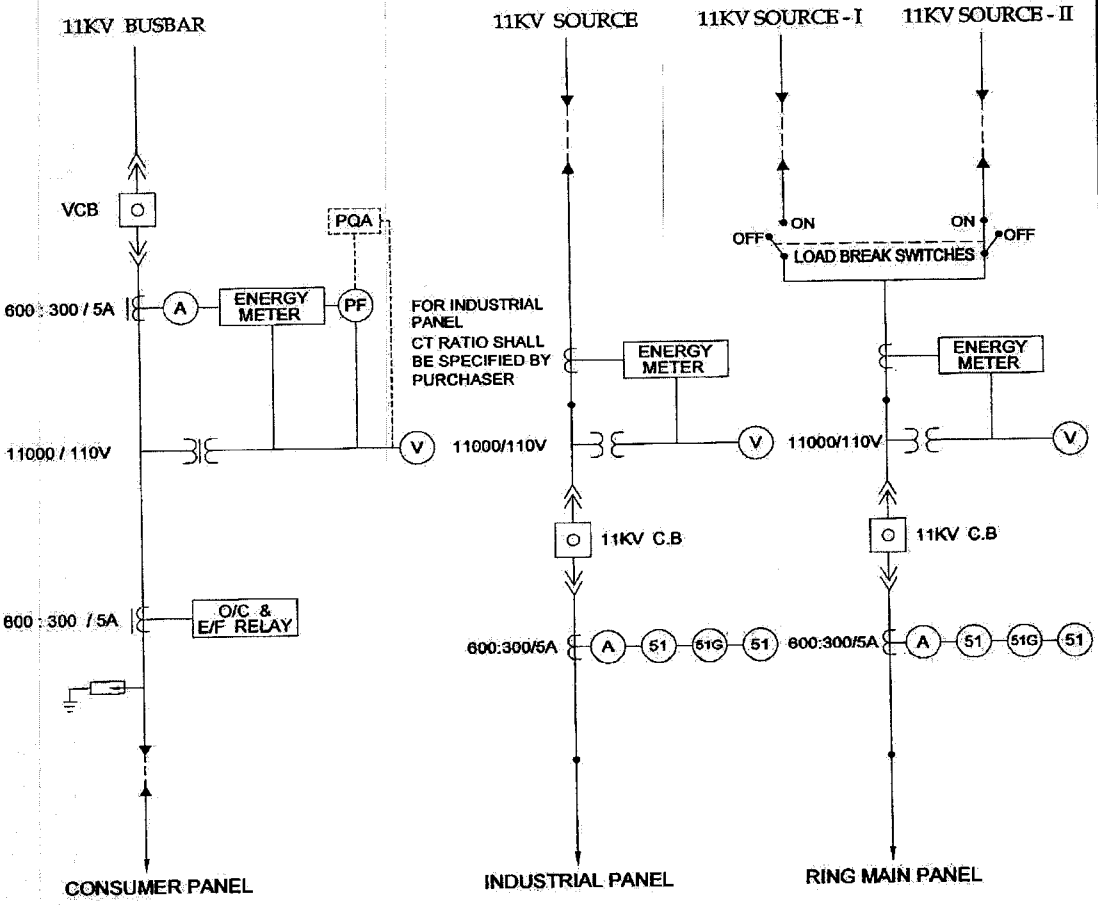
NATIONAL TRANSMISSION AND DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	M.A.REHMAN	sd.	
CHECKED	GHULAM RASUL	sd.	**BUS BAR CONNECTIONS & JOINTING**
JUNIOR ENGINEER	WAQAR-UL-HAQ	sd.	
SENIOR ENGINEER	MUHAMMAD RAFIQUE	sd.	
DIRECTOR	SHAMS-UL-HAQ	sd.	DATE :- 24-3-1985
CHIEF ENGINEER	JAVID AKHTAR		DWG. NO. PDW / DF - 297

REVISIONS	REVISED ON:-
1.TITLE CHANGED WAPDA TO NTDC	PERVAZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R



NATIONAL TRANSMISSION & DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MIAN IJAZ MAHMOOD		SINGLE LINE DIAGRAM FOR 11KV INCOMING, OUT GOING & BUS COUPLER PANELS
CHECKED			
ASSTT. MANAGER			
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID		
MANAGER	PERVAZ IQBAL		SCALE :- 1 : 1 / DATE :- 01-10-2011
CHIEF ENGINEER	NAZAR ABBAS		DWG. NO. PDW/TE - 580

NO.	DATE	REVISION	BY
1.	12-2-2018	REVISED AS PER NEW SPEC P-44:2018	



NO.	DATE	REVISION	BY
6.	12-2-2018	REVISED AS PER NEW SPEC P-44:2018	
5	11-10-2017	DRAWING REDRAWN FOR SEPRATLY DRAWN CONSUMER PANEL & CURRENT RATIO OF METERING AND PROTECTION CT CHANGED FOR ALL PANELS.	
4	05-07-1998	MODIFICATION UNDER REV:2 & 3 PERTAINING TO CONSUMER PANEL DELETED.	-Sd-
3	18-07-1996	FOR CONSUMER PANEL AMP: METER SHIFTED FROM PROT:CT TO METERING CT.	-Sd-
2	04-04-1996	CONSUMER PANEL ADDED.	-Sd-
1	24-3-1985	ISOLATOR IN RING MAIN PANEL CHANGED TO LOAD BREAK SWITCH	-Sd-

PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY

DESIGN DEPARTMENT

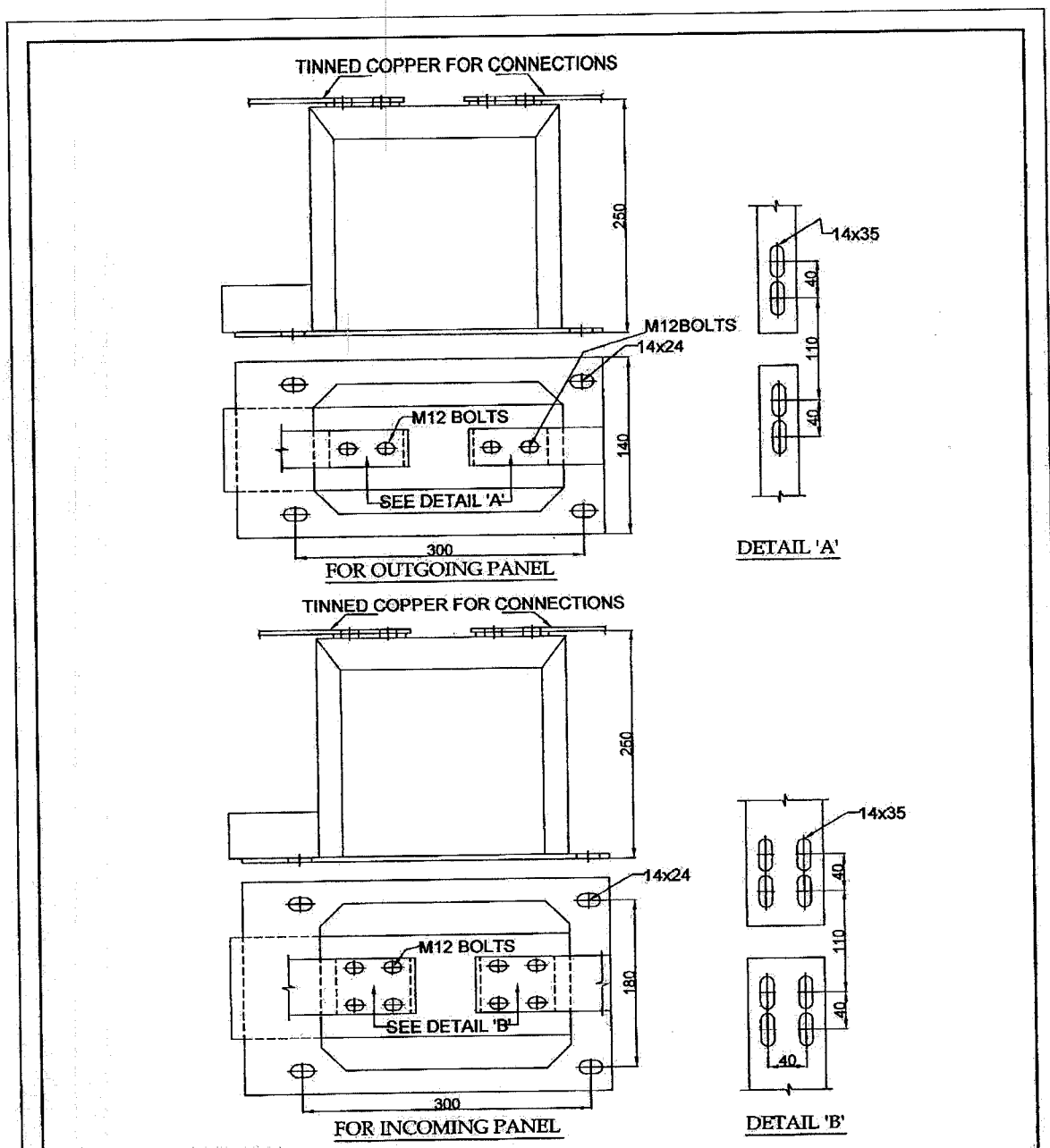
DRAWN	M.A. REHMAN	-Sd-
CHECKED	SH. M. AMIN	-Sd-
JUNIOR ENGINEER	KHAWAJA ARIF	-Sd-
SENIOR ENGINEER	MUHAMMAD RAFIQUE	-Sd-
DIRECTOR	SHAMS-UL-HAQ	-Sd-
CHIEF ENGINEER	JAVID AKHTAR	-Sd-

SINGLE LINE DIAGRAM CONSUMER / INDUSTRIAL & RING MAIN PANELS

SCALE :- NTS

DATE :- 09 - 09 - 1979

DWG. NO. PDW/TE - 581

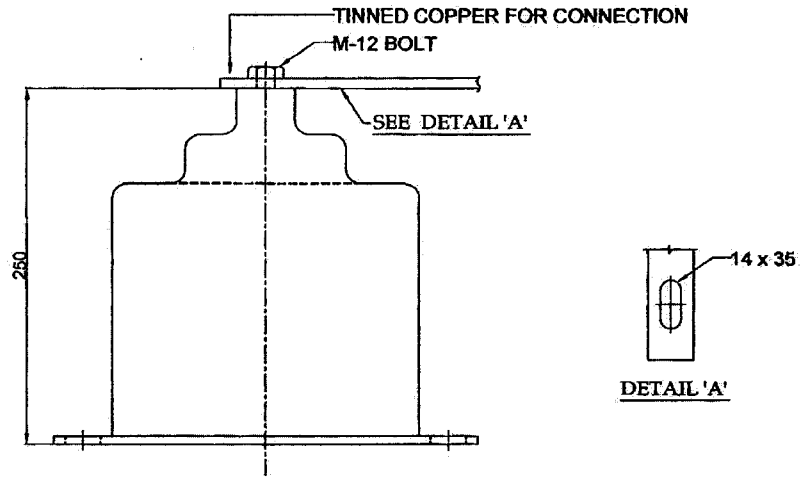


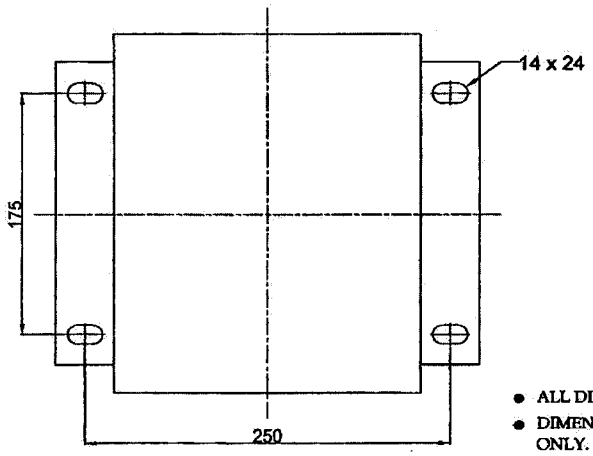
- ALL DIMENSIONS ARE IN mm.
- DIMENSIONS ARE FOR GUIDENCE ONLY.

NATIONAL TRANSMISSION & DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MUZAFFAR ALI	sd.	**CTs FOR 11KV PANELS**
CHECKED	M.A.KHAN		
ASSTT. DIRECTOR	SHAHID ALTAF	sd.	
DEPUTY DIRECTOR	NAEEM ULLAH	sd.	
DIRECTOR	R.A.BAIG	sd.	DATE :- 20-7-1987
			DWG. NO. PDW / DF - 445

REVISIONS	REVISED ON:-
TITLE CHANGED WAPDA TO NTDC	PERVAZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R
12.5KA RATING DELETED.	

POTENTIAL TRANSFORMER



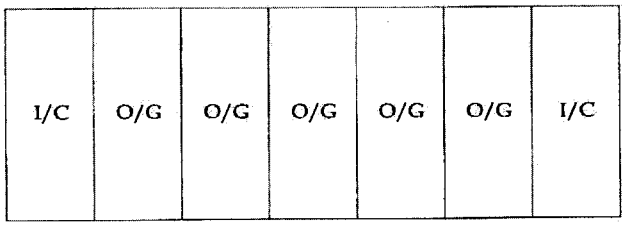


- ALL DIMENSIONS ARE IN mm.
- DIMENSIONS ARE FOR GUIDENCE ONLY.

BASE PLATE

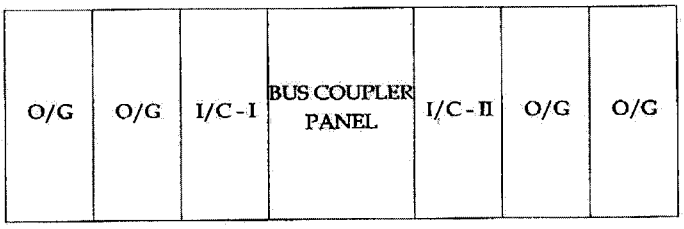
NATIONAL TRANSMISSION & DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MUZAFFAR ALI	sd.	
CHECKED	M.A.KHAN		**P.T FOR 11KV PANELS**
ASSTT. DIRECTOR	SHAHID ALTAF	sd.	
DEPUTY DIRECTOR	NAEEM ULLAH	sd.	
DIRECTOR	R.A.BAIG	sd.	DATE :- 20-7-1987
CHIEF ENGINEER			DWG. NO. PDW / DF - 446

REVISIONS	REVISED ON:-
1.TITLE CHANGED WAPDA TO NTDC	PERVAZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R



ALTERNATIVE POSITION FOR INCOMING PANEL

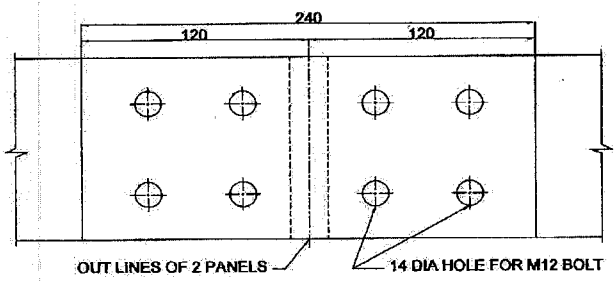
SWITCH BOARD COMPRISING OF ONE INCOMING AND NUMBER OF OUTGOING PANELS

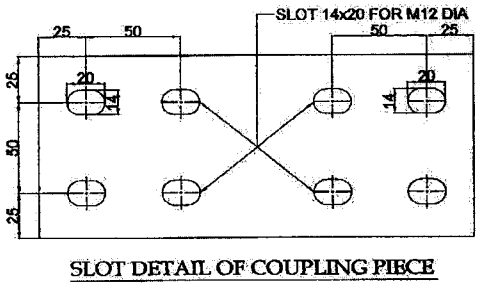


SWITCH BOARD COMPRISING TOW INCOMING PANELS ONE BUS COUPLER PANEL AND A NUMBER OF OUTGOING PANELS

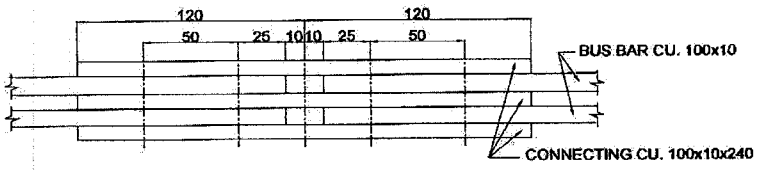
NO.	DATE	REVISION	BY

NATIONAL TRANSMISSION AND DISPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MIAN IJAZ MAHMOOD		11KV SWITCH BOARD LAYOUT
CHECKED A.D.M			
ASSIT. MANAGER			
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID		
MANAGER	PERVAZ IQBAL		SCALE:- AS SHOWN / DATE :- 12-10-2011
CHIEF ENGINEER	NAZAR ABBAS		DWG. NO. PDW / TE - 582



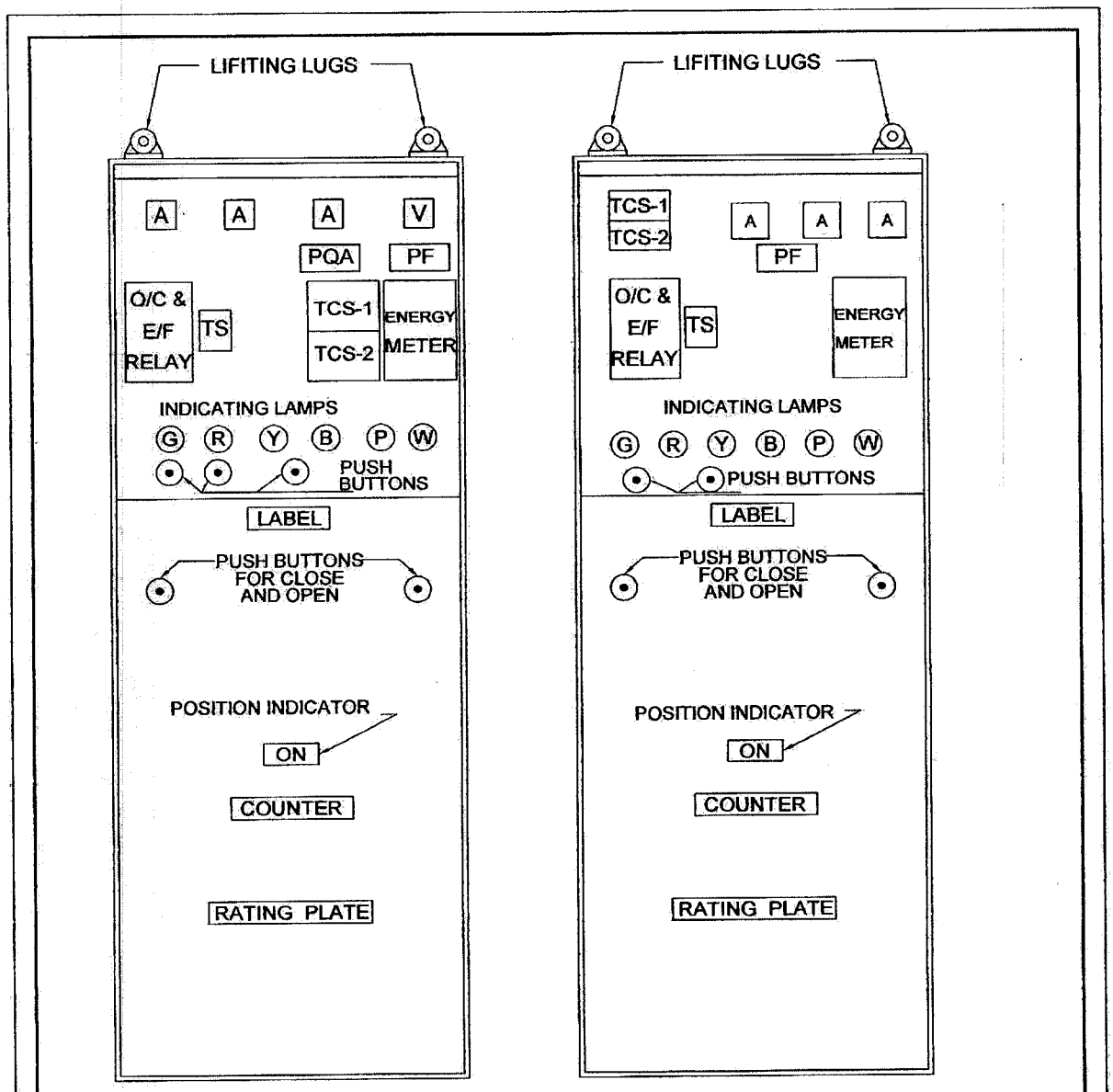


SLOT DETAIL OF COUPLING PIECE

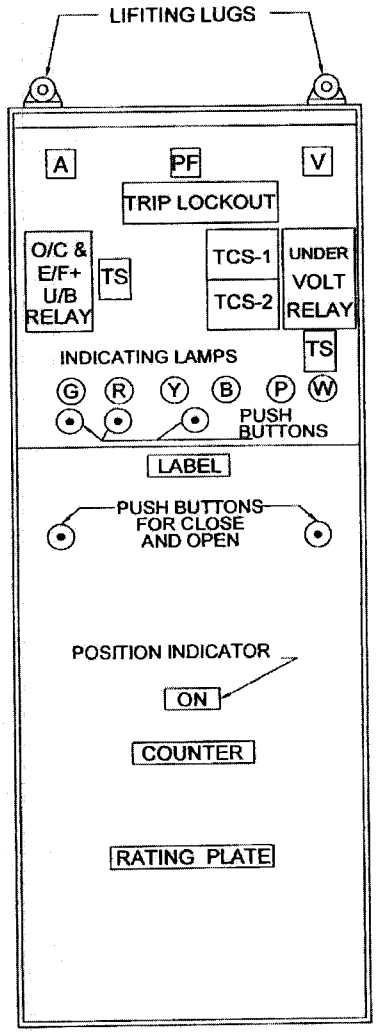


NO.	DATE	REVISION	BY

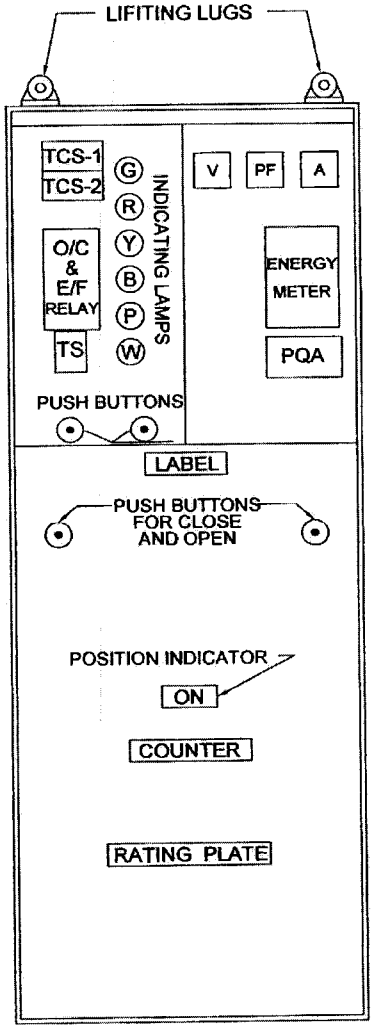
NATIONAL TRANSMISSION AND DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MIAN IJAZ MAHMOOD		COUPLING DETAILS FOR 11KV SWITCH GEAR PANELS (25 KA)
CHECKED A.D.M			
ASSTT. MANAGER			
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID		
MANAGER	PERVAZ IQBAL		SCALE :- N.T.S / DATE :- 20-10-2011
CHIEF ENGINEER	NAZAR ABBAS		DWG. NO. PDW/TS - 2010



			NATIONAL TRANSMISSION AND DESPATCH COMPANY			DESIGN DEPARTMENT	
1.	12-2-2018	REVISED AS PER NEW SPEC P-44:2018.	DRAWN	A.HASSAN	sd.	TYPICAL 11KV PANELS	
REVISIONS		REVISED ON:-	CHECKED	GHULAM RASUL	sd.		
1.TITLE CHANGED WAPDA TO NTDC		PERVAZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R	JUNIOR ENGINEER				
			SENIOR ENGINEER	M.RAFIQ	sd.		
			DIRECTOR	SHAMS-UL-HAQ	sd.	DATE :- 6-01-1998	
			CHIEF ENGINEER	JAVID AKHTAR		DWG. NO. PDW / DF - 299-A	

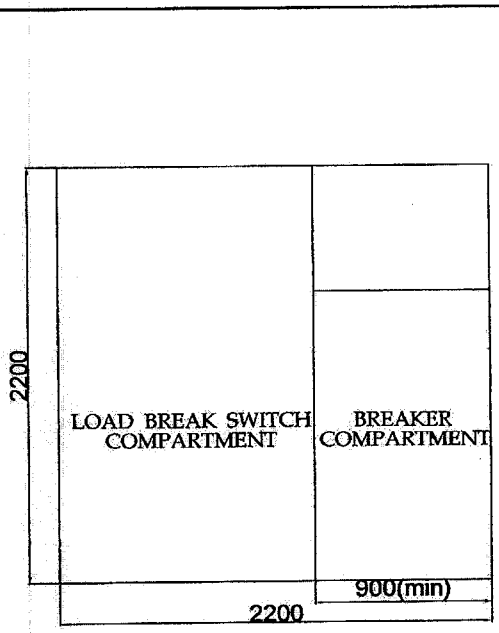


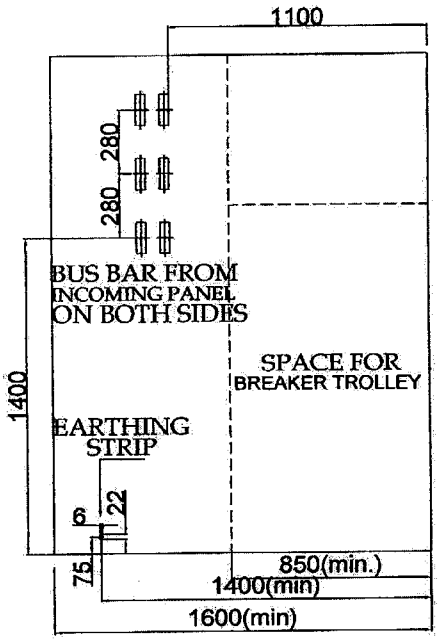
CAPACITOR CONTROL PANEL



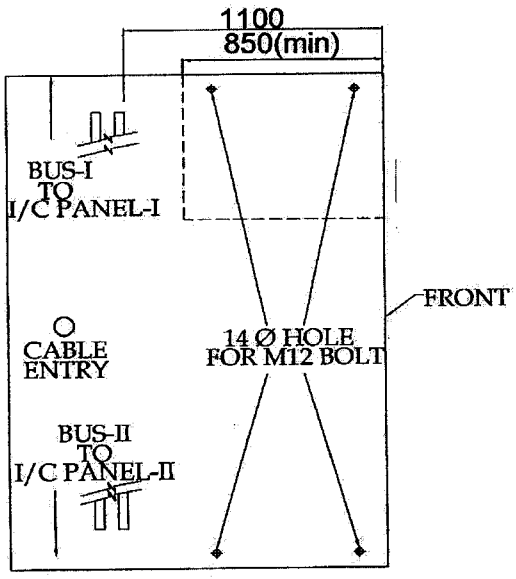
CONSUMER PANEL

				NATIONAL TRANSMISSION AND DESPATCH COMPANY			DESIGN DEPARTMENT
1.	12-2-2018	REVISED AS PER NEW SPEC P-44: 2018.		DRAWN	A.HASSAN	sd.	TYPICAL 11KV PANELS
	REVISIONS	REVISED ON:-		CHECKED	GHULAM RASUL	sd.	
1.TITLE CHANGED WAPDA TO NTDC		PERVAZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R		JUNIOR ENGINEER			
				SENIOR ENGINEER	M.RAFIQ	sd.	
				DIRECTOR	SHAMS-UL-HAQ	sd.	DATE ;- 6-01-1998
				CHIEF ENGINEER	JAVID AKHTAR		DWG. NO. PDW / DF - 299-B





(Maximum 2400 if necessary)



PANEL	BUS BAR SIZE
25KA RATING	2 x 100 x 10 mm

- ALL DIMENSIONS ARE IN mm.
- DIMENSIONS ARE FOR GUIDENCE ONLY.

1.	12-02-2018	REVISED AS PER NEW SPEC P-44: 2018.

REVISIONS	REVISED ON:-
TITLE CHANGED WAPDA TO NTDC	PERVAZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R
12.5KA RATING DELETED.	

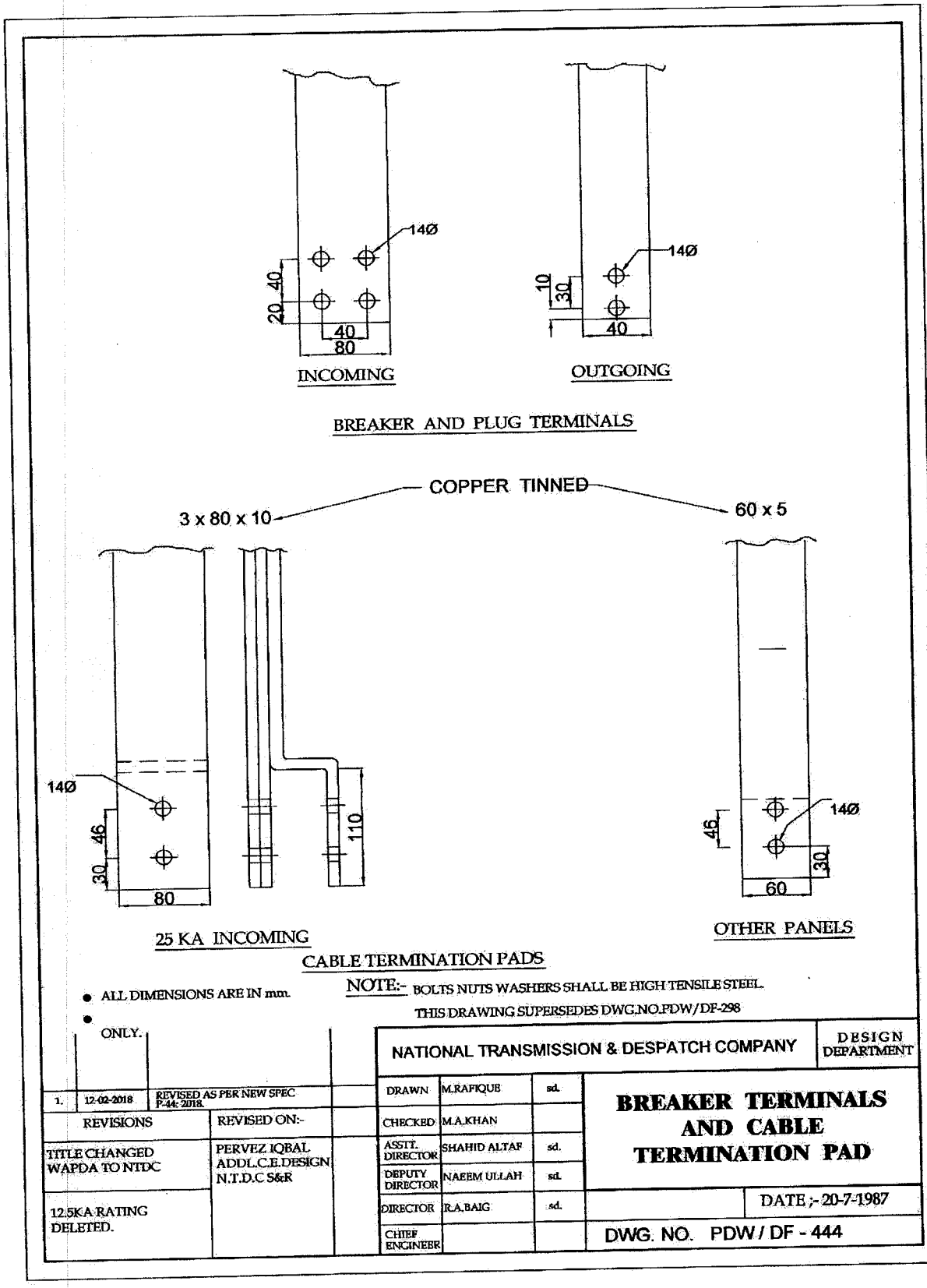
NATIONAL TRANSMISSION AND DESPATCH COMPANY | DESIGN DEPARTMENT

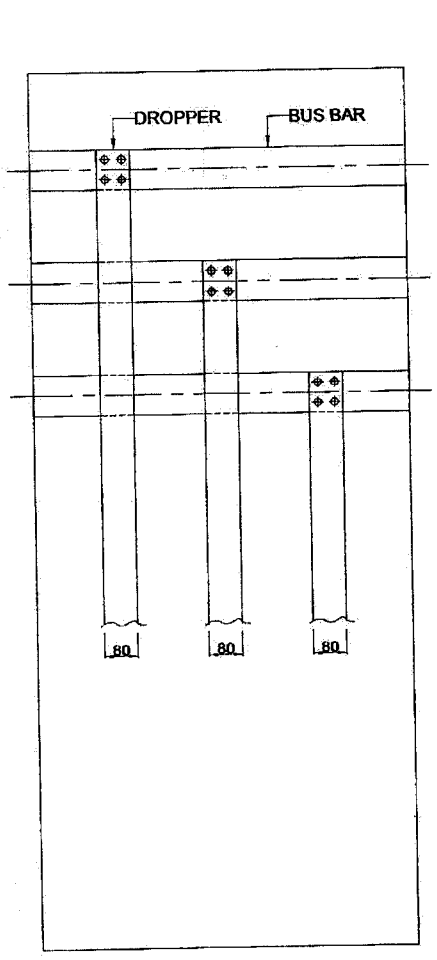
DRAWN	NAWEED AHSAN	sd.
CHECKED	ABDUL LATIF	
JUNIOR ENGINEER	MUHAMMAD AHMAD	sd.
SINIOR ENGINEER	MUHAMMAD ISMAIL	sd.
DIRECTOR	R.A.BAIG	sd.
CHIEF ENGINEER		

STANDARD DIMENSIONS
11KV BUS COUPLER PANEL

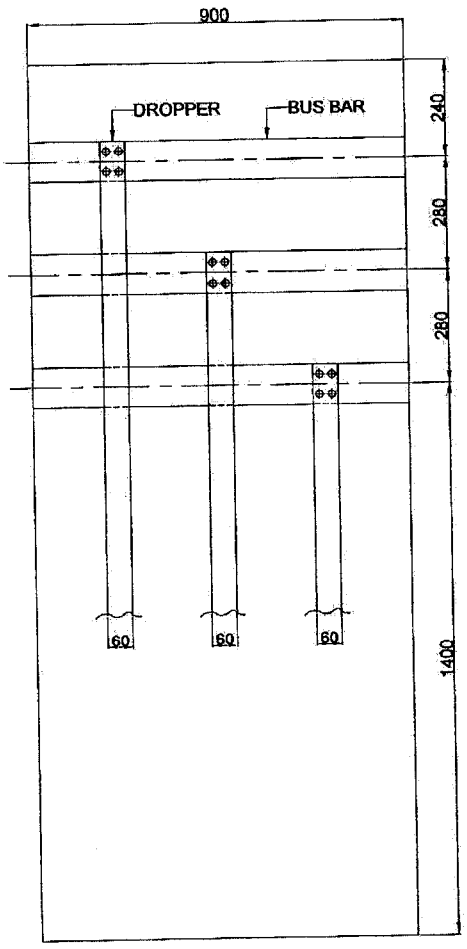
DATE :- 24-3-1987

DWG. NO. PDW/DF - 423


14Ø
40
20
40
80
INCOMING
14Ø
10
30
40
OUTGOING
BREAKER AND PLUG TERMINALS
COPPER TINNED
3 x 80 x 10
60 x 5
14Ø
46
30
80
110
25 KA INCOMING
46
14Ø
30
60
OTHER PANELS
CABLE TERMINATION PADS
NOTE:- BOLTS NUTS WASHERS SHALL BE HIGH TENSILE STEEL.
THIS DRAWING SUPERSEDES DWG.NO.PDW/DF-298
• ALL DIMENSIONS ARE IN mm.
• ONLY.
NATIONAL TRANSMISSION & DESPATCH COMPANY
DESIGN DEPARTMENT
1. 12-02-2018 REVISED AS PER NEW SPEC P-44: 2018.
REVISIONS
REVISED ON:-
TITLE CHANGED WAPDA TO NTDC
PERVEZ IQBAL ADDL.C.E.DESIGN N.T.D.C S&R
12.5KA RATING DELETED.
DRAWN M.RAFIQUE sd.
CHECKED M.A.KHAN
ASSTT. DIRECTOR SHAHID ALTAF sd.
DEPUTY DIRECTOR NAEEM ULLAH sd.
DIRECTOR R.A.BAIG sd.
CHIEF ENGINEER
BREAKER TERMINALS AND CABLE TERMINATION PAD
DATE :- 20-7-1987
DWG. NO. PDW / DF - 444



INCOMING



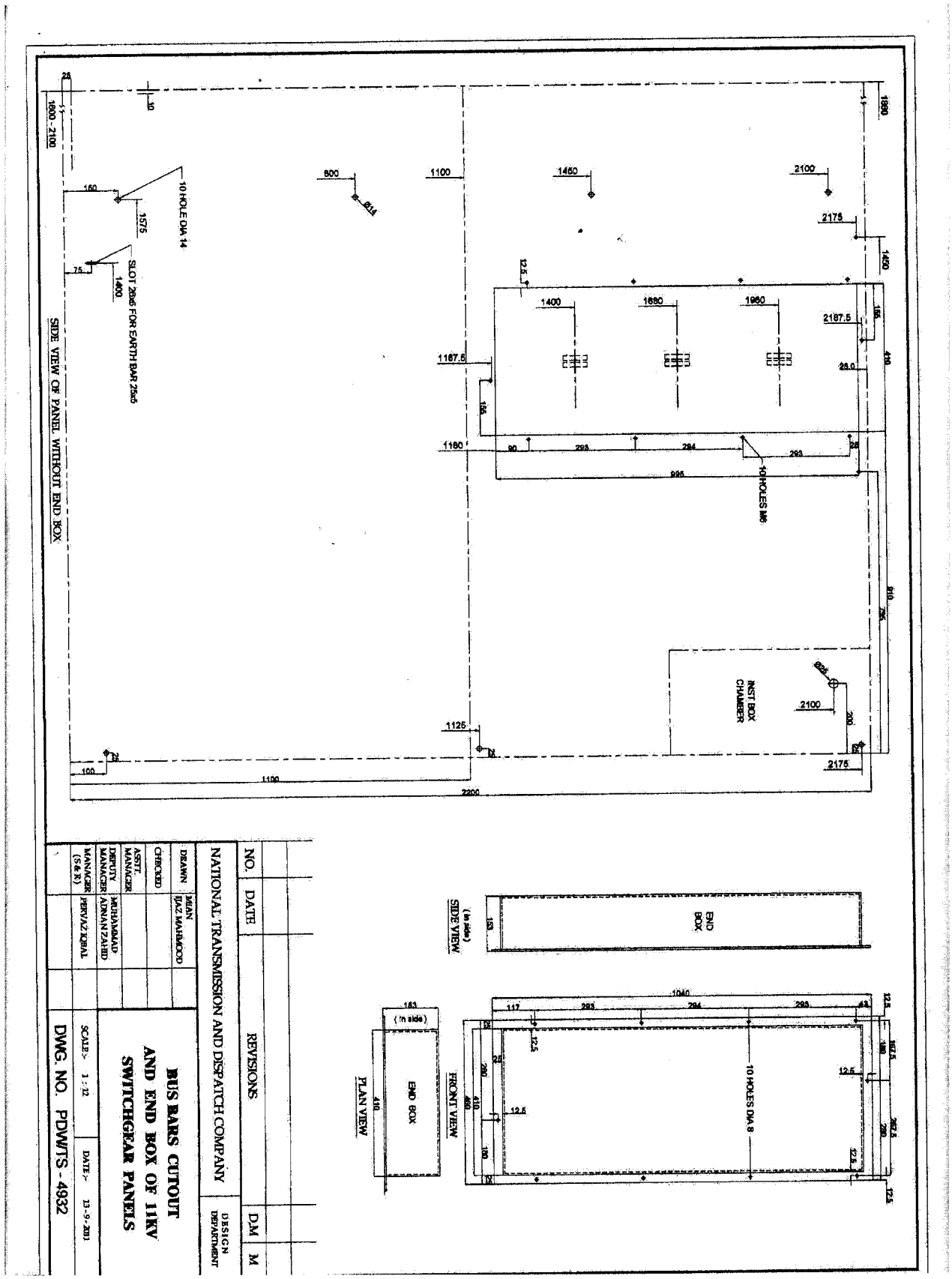
OUT COMING / Consumer

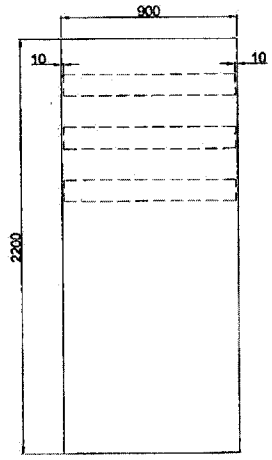
25 kA PANELS

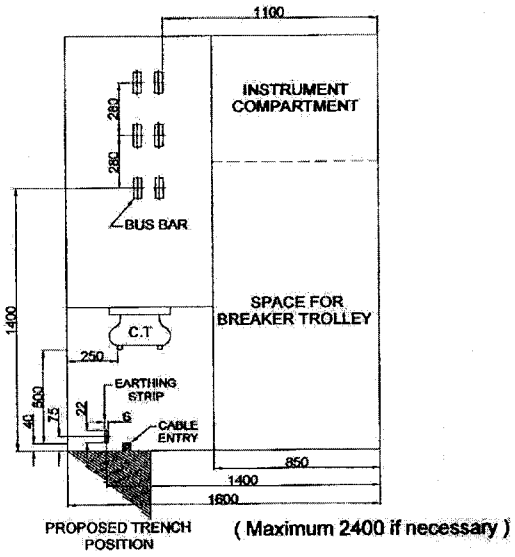
BUS BARS I/C & O/G 2x100x10
DROPPER I/C 3x80x10
DROPPER O/G 60x5

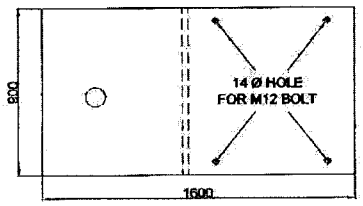
NO.	DATE	REVISION	BY
1.	12-2-2018	REVISED AS PER NEW SPEC P-44: 2018.	

NATIONAL TRANSMISSION & DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MIAN IJAZ MAHMOOD		BUS BAR AND DROPPER ARRANGEMENT FOR 11KV PANELS
CHECKED			
ASSTT. MANAGER			
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID		
MANAGER	PERVAZ IQBAL		SCALE :- N.T.S / DATE :- 04-11-2011
CHIEF ENGINEER	NAZAR ABBAS		DWG. NO. PDW / DF - 447


SIDE VIEW OF PANEL WITHOUT END BOX
10 HOLE DIA 14
SLOT 28x6 FOR EARTH BAR 25x6
10 HOLES M6
INST BOX CHAMBER
END BOX
SIDE VIEW
FRONT VIEW
PLAN VIEW
10 HOLES DIA 8
NATIONAL TRANSMISSION AND DISPATCH COMPANY
DESIGN DEPARTMENT
BUS BARS CUTOUT AND END BOX OF 11KV SWITCHGEAR PANELS
DWG. NO. PDWTS - 4932
SCALE:- 1 : 12
DATE:- 13-9-2013
DRAWN
CHECKED
ASSTT. MANAGER
DEPUTY MANAGER
MANAGER (S & R)
REVISIONS
NO.
DATE
DM
M







PANEL	BUS BAR SIZE
25KA RATING	2 x 100 x 10 mm

NO.	DATE	REVISION	BY
1.	12-2-2018	REVISED AS PER NEW SPEC P-44: 2018.	

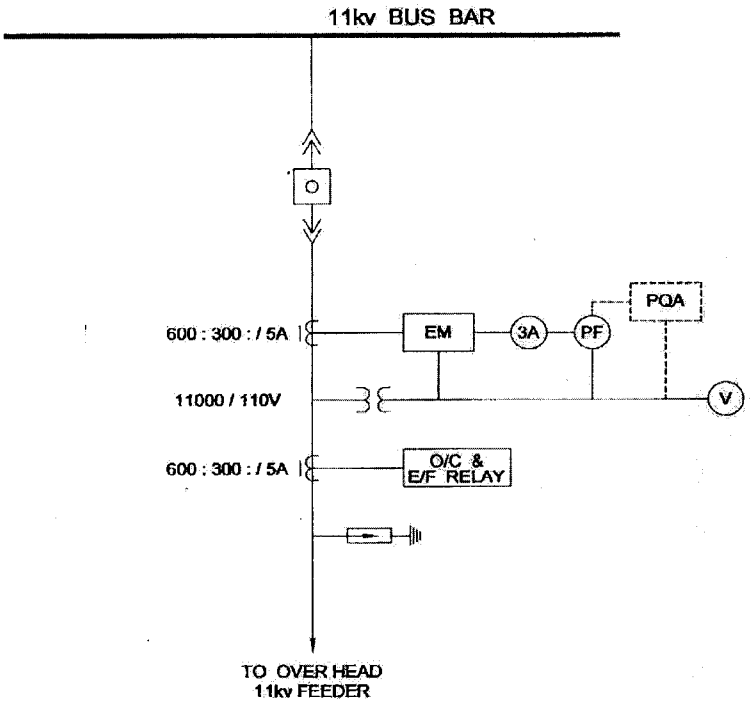
NATIONAL TRANSMISSION AND DISPATCH COMPANY — DESIGN DEPARTMENT

DRAWN	MIAN IJAZ MAHMOOD	
CHECKED A.D.M		
ASSTT. MANAGER		
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID	
MANAGER	PERVAZ IQBAL	
CHIEF ENGINEER	NAZAR ABBAS	

STANDARD DIMENSIONS 11KV PANEL - CONSUMER / INCOMING / OUTGOING

SCALE:- AS SHOWN — DATE:- 14-10-2011

DWG. NO. PDW / TS - 1630



NATIONAL TRANSMISSION & DESPATCH COMPANY			DESIGN DEPARTMENT
DRAWN	MIAN IJAZ MAHMOOD		SINGLE LINE DIAGRAM OF 11KV CONSUMER PANEL
CHECKED			
ASSTT. MANAGER			
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID		
MANAGER	PERVAZ IQBAL		SCALE:- 1 : 1 / DATE:- 29-9-2011
CHIEF ENGINEER	NAZAR ABBAS		DWG. NO. PDW/TE - 1331

NO.	DATE	REVISION	BY
1.	12-2-2018	REVISED AS PER NEW SPEC P-44: 2018.	

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PRINTING HISTORY

First Edition February, 1968
Reprinted September, 1981
Ist Revision June, 1989
Second Edition July, 2010

NTDC SPECIFICATION P-29:2010

0 FOREWORD

0.1 This specification has been prepared by the Standards & Research Directorate of the Design Department NTDC. This second edition cancels and replaces the first edition published in 1989 and its amendments.

0.2 This specification is intended for the procurement of material and does not include all the necessary provisions of a contract.

0.3 It is subject to periodical revision as and when required by S&R directorate of Design NTDC. No other department is authorized to issue any change/amendment in it.

1 SCOPE

1.1 This standard specifies the construction, dimensions and test requirements of single & three core power cables with extruded solid cross-linked Polyethylene (XLPE) insulating compound.

1.2 The designed cable voltage shall be as mentioned below:

U_o = 8.7 kV
U = 15 kV
U_m= 17.5 kV

1.3 Type of sheathing PVC compound shall be ST_2.

2. REFERENCE SPECIFICATIONS

2.1 The power cables shall comply with the requirements of following International Standards amended to date:

- IEC 60502-2, Power cables with extruded insulation and their accessories for rated voltage from 6kV up to 30kV.

IEC 60811-1-1 IEC 60811-1-2 IEC 60811-1-3 IEC 60811-1-4 IEC 60811-2-1 IEC 60811-3-1 IEC 60811-3-2 IEC 60811-4-1	Common Test methods for insulating and sheathing materials of electric cables

- IEC 60885-3, Electrical test methods for electric cables
- IEC 60986, Short circuit temperature limits of electric cables
- IEC 60228, Conductors for insulated cables
- IEC 60229, Tests on cable oversheaths
- IEC 60230, Impulse test on cables

2.2 In case the requirements laid down herein differ from those given in the above standards in any particular, the cables shall comply with the requirements indicated herein.

3 DEFINITIONS

3.1 Rated Voltage

The rated voltage U_o/U (U_m) of the Power Cable is 8.7/15 (17.5) kV where,

-U_O is the rated power frequency voltage between conductor and the earth or metallic screen for which the cable is designed.

-U is the power frequency voltage between conductors for which the cable is designed.

-U_m is the maximum value of the "highest system voltage" for which the cable may be used.

3.2 Insulating Compound

Insulation shall be extruded dielectric type cross-linked Polyethylene (XLPE).

3.3 Sheathing Compound

Polyvinyle Chloride (PVC) type ST_2.

3.4 Conductor

The conductor shall be plain Aluminium or Aluminium alloy or Annealed Copper in accordance with IEC 60228.

4. RATING & SERVICE CONDITIONS

4.1 The cables shall be suitable for operation in 15,000 volts, 50 c/s three phase distribution system. Three core cables shall be operated in a three phase three wire system with the power transformer neutral solidly grounded. Single core cables shall be used on either three phase four wire or a single phase two wire system.

4.2 The cables shall be suitable for direct burial or installation in ducts. The duct and soil conditions vary form dry to wet. Highly corrosive salts are encountered in the soils. The ambient temperature ranges from minus 10 °C to 50°C.

4.3 The maximum conductor temperature for the insulating XLPE compound shall be as follows:

Normal Operation	=	$90^{o}C$
Short Circuit (5 s max. duration)	=	$250^{o}C$

5 CONSTRUCTION REQUIREMENTS

5.1 Single Core Cables

5.1.1 The conductor shall consist of stranded circular compacted Aluminium/Copper of electrical grade purity in accordance with IEC-60228 having tensile strength between 843.6 and 1406 kg/cm² for Aluminium conductor.

5.1.2 The stranded compacted conductor shall be covered by an extruded semi-conducting compound layer having minimum thickness of 0.7mm which shall adhere firmly to it.

5.1.3 The cross-linked polyethylene (XLPE) insulation shall be applied over the semi-conducting layer and shall be permanently and completely bounded to it without any voids.

5.1.4 A layer of semi-conducting compound having a minimum thickness of 0.7mm shall be extruded directly upon the cross-linked polyethylene (XLPE) insulation of each core and consist of either a bonded or strippable semi-conducting compound.

5.1.5 A metallic screen of one or more annealed copper shielding tapes or a combination of copper wires and tapes shall be applied helically to the surface of the insulation over the semi-conducting layer with an over-lap of 50% of the tape width. The minimum DC resistance of copper shielding screen of each core shall not exceed the values given in Table-1.

5.1.6 An aluminium wire armouring if required in the tender/order shall be applied helically over the inner PVC bedding (Separation Sheath type ST_2 extruded over the metallic screen).

5.1.7 The polyvinyl chloride oversheath (ST_2 Type) of black colour shall then be applied over the copper shielding and shall fit tightly over it.

5.2 Three Core Cables

5.2.1 The construction of the individual core of three core cable shall be the same as for single metallic shielded core cable stated in clause 5.1 above, except that the over all sheath as indicated in sub clause 5.1.6 shall not be applied on the individual cores.

5.2.2 The three individual metallic shielded cores shall be laid up having metal contact with each other. The minimum resistance of copper shielding screen of complete three cores shall not exceed the values given in Table-I. The length of the lay of individual core shall not exceed 30 times the assembled core diameter. The interstices shall be filled with polypropylene fillers.

A suitable thick non-hygroscopic binding tape made of polypropylene shall then be applied helically over the laid up cores with a suitable overlap to form compact circular assembly.

5.2.3 The cable shall then be covered tightly with a separator sheath made of extruded layer of black polyvinyl chloride compatible with the operating temperature of the cable and complying with the requirements for type ST_2 of sheathing compound based on PVC.

5.2.4 A steel wire armouring shall be applied helically over the inner PVC bedding (separator sheath).

5.2.5 An extruded layer of overall black PVC compound type ST_2 oversheath shall then be applied over the armouring.

5.2.6 The cores shall be positively identified with colours preferably Red, Yellow & Blue by applying coloured tape along each core for which necessary approval of Design NTDC be obtained.

6. DIMENSIONS AND CHARACTERISTICS

6.1 The size of cables for both single core and three core cables are as under:-

Sr.No.	Cross-Sectional area of cable	Cores
1.	35 mm^2	Single & Three
2.	120 mm^2	-do-
3.	240 mm^2	-do-
4.	500 mm^2	Single

6.2 The dimensions of the conductor, insulation, semi-conducting layer, PVC separation sheath and armouring shall be in accordance with Table-1.

6.3 The diameter of stranded compacted circular conductor shall not exceed the max. values and shall not be less than the min. values given in Table-1.

6.4 The D.C. resistance of the complete compacted conductor shall not exceed the values given in table-1.

6.5 The average thickness of the XLPE insulation, semi-conducting compound, separation sheath and oversheath shall not be less than the specified nominal value given in Table -1. The negative tolerance at any point shall not be more than 5% of the nominal value.

6.6 The tolerance on the nominal dimension of armour wire given in Table -1 shall not fall below the nominal value by more than 5%.

6.7 In case of stranded compacted circular conductor, the ratio of the diameters of two different wires in the same conductor shall not exceed 2.

TABLE-1

1.	Nominal Cross-Sectional area of Conductor (sq.mm)	35	120	240	500
2.	Minimum No. of Aluminium wires	6	15	30	53
3.	Minimum No. of copper wires	6	18	34	53
4.	Complete Conductor diameter (mm)				
	- Min.	6.6	12.3	17.6	25.3
	- Max	7.5	13.5	19.2	27.6
5.	Complete Aluminium Conductor max. D.C. Resistance at 20°C (ohms/km)	0.868	0.253	0.125	0.0605
6.	Complete copper Conductor max. D.C. Resistance at 20°C (ohms/km)	0.524	0.153	0.0754	0.0366
7.	Nominal thickness of XLPE Insulation (mm)	4.5	4.5	4.5	4.5
8.	Nominal thickness of semi-conducting compound layer over Conductor (mm)	0.7	0.7	0.7	0.7
9.	Nominal thickness of semi-conducting compound over Insulation (mm)	0.7	0.7	0.7	0.7
10.	DC resistance of copper screen at 20°C (Ω/km)	1.15	1.15	0.727	0.524
11.	Nominal thickness of PVC oversheath (mm)				
	- Single Core (Unarmoured)	1.6	1.8	2.0	2.3
	- Single Core (Armoured)	1.8	2.1	2.3	2.6
	- Three Core	2.7	3.2	3.6	-
12.	Nominal thickness of PVC separation Sheath (mm) - Single Core (Armoured)	1.2	1.2	1.2	1.3
	- Three Core	1.4	1.7	1.9	-
13.	Dia. of aluminium armouring wire (mm) for single core cable	1.6	2.0	2.0	2.5
14.	Dia. of Galvanised armouring wire (mm) for three core cable	2.5	2.5	3.15	-
15.	Power frequency test voltage for 4 hours on 5 meter sample cable (kV rms)	35	35	35	35
16.	Power Frequency Test voltage for 5 minutes on each manufactured length of individual core on a reel (kV rms)	30.5	30.5	30.5	30.5
17.	Partial Discharge on each manufactured length of cable for routine tests (Max.)	10pC	10pC	10pC	10pC
18.	Partial Discharge on each manufactured length of cable for prototype tests (Max.)	5pC	5pC	5pC	5pC

7. INSULATION

7.1 Cross-linked Polyethylene (XLPE)

7.1.1 The cross-linked polyethylene (XLPE) insulation shall be suitable for use in wet and dry locations, and a continuous conductor operating temperature of 90°C throughout its life and for service under the conditions described in clause 3. The XLPE insulation shall meet the following requirements

7.1.2 Mechanical Properties

(i) Without Ageing

a)	Tensile strength, minimum	12.5 N/mm² (1.275 kg/mm^2)
b)	Elongation at break, minimum	200%

(ii) After Ageing in Air oven Without Conductor

Air oven exposure at 135±3°C for 168 hours.

a)	Tensile strength, Variation of unaged value, maximum	±25%
b)	Elongation, Variation of unaged value, maximum	±25%

7.1.3 Water Absorbtion

When tested after immersion in water at 85 ± 2°C for 336 hours, the maximum increase of mass shall not exceed 1.0 mg/cm².

7.1. 4 Hot Set Test

a)	Temperature	200±3^{o}C
b)	Time under load	15 minutes
c)	Mechanical Stress	20 N/cm^2
d)	Max. elongation under load	175%
e)	Max. permanent elongation after cooling	15%

7.1. 5 Shrinkage Test

a)	Length of sample	200mm
b)	Temperature	130±3^{o}C
c)	Duration	1 hr
d)	Max. shrinkage	4%

8 OVERSHEATH

8.1 Polyvinyl Chloride (PVC) Oversheaths

8.1.1 The PVC sheaths type ST_2 shall be made from sulphur free polyvinyl chloride compound suitable for a minimum installation temperature of -10 °C and shall meet the following requirements.

8.1.2 Mechanical Properties

(i) Without Ageing

a)	Tensile strength, minimum	12.5 N/mm² (1.275 kg/mm²)
b)	Elongation at break, minimum	150%

ii) After Ageing In An Air Oven Without Conductor

Air oven exposure at 100±2°C for 168 hrs

a)	Tensile strength, minimum	12.5 N/mm² (1.275 kg/mm²)
	Variation of unaged value, Maximum	±25%
b)	Elongation at break, minimum	150%
	Variation of unaged value, aximum	±25%

8.1.3 Loss of mass after ageing, Maximum 1.5mg/cm^2

8.1.4 Pressure Test at 90°C ±2°C as per IEC 60811-3-1, Clause 8

8.1.5 Heat Shock test at 150 ± 3°C for 1 hour as per IEC 60811-3-1, Clause 9

8.1.6 Behaviour at -15°C±2°C as per IEC 60811-1-4, Clause 8
- Cold Bending Test
- Cold Elongation Test on dumb-bell
- Cold impact test

9 WIRE ARMOURING

9.1 The nominal dia of the aluminium/steel wire armour shall not be less than the value given in Table-1. A joint in any wire shall not be less than 1m from the nearest joint in any other armour wire.

9.2 The wire armour shall be made closed i.e. with minimum gap between adjacent wires.

9.3 The steel wire shall be hot dip galvanized only.

9.4 The weight of zinc coating shall be 195 gm/m². The coating shall not flake and none of it may be removed by rubbing of the fingers.

9.5 The tensile strength of the steel wire shall be in range of 2812-4921 kg/cm² in gauge length of 250mm and minimum elongation shall be 10%.

9.6 The aluminium wire shall have the same characteristics as used in the aluminium conductor.

9.7 Armouring shall be laid up with a left or right hand lay but in opposite direction to the lay of cores. The length of lay shall not exceed 30 times, the diameter over the inner PVC (separator) sheath.

10 TESTS

10.1 The power cables shall be tested in accordance with the latest relevant IEC standards. The tests shall be made at an ambient temperature of -5°C to 40°C. The cable manufacturer shall submit the test reports with the bid, in case of non-submission, the bid be considered as non-responsive.

10.2 Routine Tests

The following routine tests shall be carried out on each manufactured length of cable supplied on a reel.

i) Measurement of electrical resistance of the conductor (Clause 16.2 of IEC 60502-2)
ii) Measurement of partial discharges (Clause 16.3 of IEC 60502-2)
iii) Power frequency voltage test

10.2.1 Partial Discharge Test

Each length of cable shall comply with the minimum partial discharge given in Table-1. The test voltage shall be raised to and held at $2U_o$ for 10 seconds then slowly reduced to $1.73U_o$ for measurement of partial discharge.

10.2.2 Power Frequency Voltage Test

Each length of cable on a reel shall withstand the power frequency test voltage of 30.5kV rms for 5 minutes between conductor & metallic screen. The frequency of alternating test voltage shall be in the range of 49 Hz to 61 Hz. The waveform shall be sinusoidal.

10.3 Sample Tests

The following sample tests shall be carried out on the randomly selected samples from the offered cable lengths. The No. of samples to be selected shall be 10% of the number of lengths offered for inspection with a min. of two samples:

i) Conductor examination (Clause 17.4 of IEC 60502)
ii) Check of dimensions & visual inspection
iii) Power frequency voltage test for 4 hours on atleast 5 meter in length (Clause 17.9 of IEC 60502-2)
iv) Hot set test for XLPE insulations (Clause 17.10 of IEC 60502-2)
v) Resistivity of semi-conducting screens before ageing (Clause 18.1.9 of IEC 60502)
vi) Hot Pressure test at high temperature on PVC oversheath (IEC 60811-3-1 clause 8)
vii) Behaviour of PVC oversheath at low temperature (IEC 60811-1-4 clause 8)
viii) Heat shock test on PVC oversheath (IEC 60811-3-1 clause 9)
ix) Hot set test for XLPE insulations
x) Flame spread test on single cable
xi) Shrinkage test for XLPE insulation

10.4 Type Test

10.4.1 These tests are of such a nature that after they have been made, they need not to be repeated, unless changes are made in the cable material or design or manufacturing process. However, in order to ensure/check the quality of the material, the purchaser reserves the right to repeat the type tests on randomly selected samples of power cable after every five years at the cost & arrangement of the cable manufacturer.

10.4.2 Electrical Tests:

Following electrical type tests shall be carried out on a sample of 10meter to 15meter in length in accordance with clause 18 of IEC 60502. The sequence of the tests shall be as follows:

i) Bending test followed by a partial discharge test (Clause 18.1.3 & Clause 18.1.4 of IEC 60502)
ii) Tangent δ measurement (Clause 18.1.2 & Clause 18.1.5 of IEC 60502)
iii) Heating cycle test followed by a partial discharge test (Clause 18.1.6 of IEC 60502)
iv) Impulse voltage withstand test followed by a power frequency voltage test (Clause 15.3 & Clause 18.1.7 of IEC 60502)
v) Power frequency voltage test for 4 hours (Clause 18.1.8 of IEC 60502)
vi) Resistivity of semi-conducting screen before and after ageing (Clause 18.1.9 of IEC 60502)

10.4.2.1 Electrical type tests successfully performed on a higher size of cable covered by this standard with a specific conductor cross-sectional area and rated voltage, the prototype approval shall be accepted as valid for cables of same type with other cross-sectional area or rated voltage provided following conditions are satisfied:

i) Same material i.e. insulation & semi-conducting screen & same manufacturing process is used.
ii) Same rated voltage as that of tested/approved cable.
iii) The conductor cross-sectional area is not larger than that of the tested/approved cable.
iv) The properties of the conductor are same as that used in the tested/approved cable.

10.4.2.2 The prototype testing performed on the armoured cable shall also be valid/applicable on the same rating/size/construction of unarmoured tested/approved cable.

10.4.3 Non-Electrical Tests:

Following non-electrical type tests shall be carried out in accordance with clause 19 of IEC 60502.

i) Check of Dimensions including measurement of thickness of insulation & sheaths
ii) Resistivity of extruded semi-conducting screens applied over the conductor and insulation (Clause 18.1.9 of IEC 60502)
iii) Test for determining the mechanical properties of insulation & oversheath before and after ageing
iv) Additional Ageing Test on pieces of completed cable (Clause 19.5 of IEC 60502)
v) Hot Pressure test at high temperature on PVC oversheath (IEC 60811-3-1 clause 8)
vi) Behaviour of PVC oversheath at low temperature (IEC 60811-1-4 clause 8)
vii) Loss of mass test on PVC oversheath of type ST_2 (IEC 60811-3-2 clause 8.2)
viii) Heat shock test on PVC oversheath (IEC 60811-3-1 clause 9)
ix) Hot set test for XLPE insulations
x) Flame spread test on single cable
xi) Water absorption test on XLPE insulation (IEC 60811-1-3)
xii) Shrinkage test for XLPE insulation

11 MARKING AND PACKING

11.1 Name of manufacturer & purchaser with order No. & date and year of manufacturing shall be superscribed after every meter length of all the cables on the outer surface of PVC oversheath in the form of protruding mould.

11.2 The cable shall be placed on non-returnable wood reels. The complete periphery of each reel shall be protected with heavy wood lagging bound with galvanized steel straps. The reels and lagging shall be sufficiently strong to withstand the rigors of marine shipment. The lagging and reels shall be pentachlorophenol treated for protection against vermin. The cable shall be supplied in the manufacture's standard lengths with a minimum as given below:

Sr. No.	Cross-Sectional area of cable	Minimum Length (meters)	
		Single Core	Three Core
1.	35 mm^2	600	300
2.	120 mm^2	500	250
3.	240 mm^2	400	200
4.	500 mm^2	300	-

11.3 Each reel shall be marked with the following particulars together with the direction of unrolling and the position of the cable end:

i) Conductor/metal designation viz Aluminium/Copper
ii) Conductor nominal sectional area
iii) Number of cores
iv) Length
v) Weight (net gross)
vi) Manufacturer's name
vii) Year of manufacture

12 TECHNICAL DATA

12.1 The following detailed technical data of power cables offered shall be furnished with the bid. Non-submission of the said technical data may render the bid as non-responsive.

SCHEDULE OF TECHNICAL DATA OF 15kV XLPE POWER CABLE (NTDC SPECIFICATION P-29:2010)

GENERAL

1. Power Cable Manufacturer's name
2. Address of Correspondence
3. Fax No./ Email
4. Type of cable
5. Rated voltage
6. Type Test Certificate (Attach Copy)
   a) Issuing Authority
   b) No. and date

CONDUCTOR

7. Material of conductor
8. Crosslinked Polyethylene cable conductor operating Temperature for:
   a) Continuous Operations
   b) Short - circuit
9. Cross-Sectional Area of conductor
10. Dia of conductor of each core
11. No. of wires in a conductor
12. Max. Complete Conductor D.C. resistance at 20° C
13. Current rating
    a) In air
    b) In ducts
    c) Laid direct
14. Short-current rating 1 second

CONDUCTOR SHEILDING

(Attach catalogue(s)/broucher(s) of semi conducting compound manufacturer(s) with the bid)

15. Name of Semi Conducting Compound Manufacturer(s) with Complete addresses(es)
16. Material of semi-conducting layer over the conductor
17. Thickness of semi-conducting layer over the conductor
18. Process of making semi-conducting layer over the conductor

CROSS-LINKED POLYETHYLENE INSULATION (XLPE)
(Attach catalogue(s)/broucher(s) of XLPE manufacturer(s) with the bid)

19. Name of XLPE insulation
    Manufacturer(s) with Complete address(es)
20. Material of insulation
21. Thickness of insulation
22. Dia over insulation
23. Dia under insulation
24. Tensile strength
25. Elongation at rupture, min. percent
26. Tensile strength after exposure to
    air oven for 168 hours at 135 ± 3°C
27. Elongation after exposure to air
    oven for 168 hours at 135 ± 3°C
28. Water absorption after remaining
    immersed in water for 336 hours at
    85 ± 2°C.
29. Elongation after hot set test
    Max. permanent elongation after
    Cooling
30. Power frequency Voltage withstand for
    5 minutes _____kV
31. Partial Discharge
32. Insulation resistance

INSULATION SHIELDING
(Attach catalogue(s)/broucher(s) of Semi-conducting compound manufacturer(s) with the bid)

33. Name of Semi-Conducting
    compound manufacturer(s)
    with complete address (es)
34. Material of semi-conducting layer
    over the insulation
35. Thickness of semi-conducting layer
    over the insulation
36. Resistivity of semi-conductor screen
    Before ageing
    - Conductor screen
    - Insulation screen
37. Resistivity of semi-conductor screen
    after ageing
    - Conductor screen
    - Insulation screen

METALLIC SCREEN
(Attach catalogue(s)/broucher(s) of metallic screen manufacturer(s) with the bid)

38. Name of Metallic Screen Manufacturer(s) with complete address(es)
39. Max. DC resistance of copper screen
40. Thickness of Copper tape
41. Width of Copper tape
42. No. & size of copper wires used

FILLERS AND BINDING

43. Material of fillers
44. Material of binding tape
45. Thickness of binding tape
46. Overlap of binding tape (percent of tape width)
47. Direction of lay of the three cores
48. Length of lay (multiple of individual core dia)
49. Minimum bending radius (mm)

WIRE ARMOUR

50. Dia of Aluminium/steel wire
51. Tensile strength of aluminium/steel wire armour
52. Process of galvanizing the wire
53. Weight of zinc coating on wire

P.V.C OVERSHEATH
(Attach catalogue(s)/broucher(s) of PVC manufacturer(s) with the bid)

54. Name(s) of PVC Manufacturer(s) with complete address (es)
55. Thickness of inner PVC oversheath
56. Type of PVC
57. Thickness of PVC oversheath
58. Minimum installation temperature of PVC
59. Tensile strength of PVC oversheath
60. Elongation at rupture of PVC oversheath

61. Results before & after exposure to Air Oven:
    a) Tensile Strength
    b) Elongation
    c) Tensile strength,
       minimum percent of unaged value
    d) Elongation,
       minimum percent of unaged value
62. Loss of mass

PACKING AND SHIPPING

63. Nominal length of cable on reel
64. Net weight of cable on reel/
    total weight of reel
65. Dimensions of reel:
    a) Drum diameter
    b) Flange diameter
    c) Flange thickness
    d) Drum length between flanges

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