National Grid Company of Pakistan Limited (NGC)

(Formerly NTDC)

BIDDING DOCUMENT NO.
XEN-EHV-II-NGC-HYD-02-2026

Installation, Erection, Testing & Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II

SINGLE STAGE SINGLE ENVELOPE (SSSE) BIDDING PROCEDURE

August, 2026

Issued to: _____

Payment Mode: _____

Date: _____

Sign & Stamp: _____

INVITATION TO BID

1. National Grid Company of Pakistan (NGC) [Formerly NTDC] "the Employer", responsible for development and control of power transmission system in the country, invites sealed bids through "Single Stage Single Envelope Procedure" on National Competitive Bidding (NCB) basis from eligible firms as defined under IB-3 of Instructions to Bidders of the Bidding Documents, registered with Income Tax and Sales Tax Departments and who are on Active Taxpayers List of the Federal Board of Revenue (if applicable) for following scope of work:-

   Scope of Work: TENDER NO. XEN-EHV-II-NGC-HYD-02-2026:

   Erection, Installation Testing and Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II

2. Bidding Documents, containing detailed terms and conditions, etc. are available at
   Office of the **Executive Engineer, TLC Division, EHV-II, NGC of Pakistan**
   Bungalow No. B-2 NTPS Colony, T.M Khan Road,
   Site Area, Hyderabad
   Telephone No. 0335-7401970
3. The Bidder, whether participating as a sole entity, a lead partner of a Joint Venture, or an approved subcontractor, shall demonstrate experience as a main contractor or subcontractor in the successful execution of construction contracts of at least one (01) No. 220kV or higher rating substation/ Power House Switchyard with similar scope of work within the last five (05) years.
4. For the above or other contracts/sub-contracts executed during the period stipulated here above, the Bidder shall have a minimum construction experience, comprising of Civil Works, erection, testing and commissioning of at least one 220kV or higher rating Transmission Line Bay and one complete 220kV or higher rating Auto Transformer Bay. Such substation/ Power House switchyard must have been operating successfully for at least two (02) years prior to deadline for submission of Bids.
5. If the Bidder has executed the above contract(s) as a JV partner, he must substantiate that he has carried out all the activities mentioned here above. In case the bid is submitted by a joint venture, Lead Partner shall meet the above experience criteria. However, each partner, other than Lead Partner, shall have experience of execution of construction contracts of at least 132kV or higher rating substation/ Power House switchyard as main contractor or as approved subcontractor during last five (05) years. The Bidder shall submit with the Bid evidence in this regard including inter alia copies (with English translation) of the contract agreement(s) and substantial completion certificate(s), Performance certificate duly notarized, for the contract(s).
6. The bidder shall have his own key construction and erection equipment in good working condition as listed Tender Document, the bidder shall have his own required equipment duly supported with documentary evidence/catalogues/drawings for undertaking such like works in good working condition. Alternatively, if not so, the bidder will identify the confirmed source of the said machinery, T&P etc. along with documentary evidence/catalogues/drawings and shall provide necessary guarantee/surety that he will arrange the said equipment in good working condition through its own resources prior to start of erection activity. The aforementioned documentary evidence shall be submitted with the bid.
   - The above contracts may have been executed by the Bidder as a single entity, a JV partner, or as an approved subcontractor, provided proper documentary evidence is submitted.
   - Documentary evidence such as completion certificates, operation records, and client references must be provided to substantiate the above experience.
   - All experience shall be demonstrated with appropriate supporting documents including scope of work, client confirmation, project dates, and voltage level.

7. All Bids must be accompanied by a Bid Security in an amount not less than Rs. 600,000 in format prescribed in the Bidding Documents.

8. **ELIGIBILITY & SALE OF TENDER**

   A. Income Tax clearance certificate & return filed with Income Tax Department for financial year 2024-2025.
   B. Registered with Income Tax and Provisional Sales Tax Departments and who are on Active Tax payers List of the Federal Board of Revenue and registered with PEC in appropriate category as per NTDC specifications and renewed / valid up to date in the relevant category with original certificate. (Details, types and quantities mentioned in the bidding document).
   C. A complete set of Bidding documents, in English Language, can be purchased by interested bidder during office hours from o/o Executive Engineer TLC Division EHV-II NGC Hyderabad from the date of publication of NIT on or before one day of opening of tender upon the submission of written request to the Office of Executive Engineer TLC Division EHV-II NGC Hyderabad
   D. Bidding document will be issued only to the proprietor of firm or his legally Authorized

representative with CNIC (In original).

E. All the Govt. taxes (Federal / Provincial) will be applicable as per relevant Govt. Notifications.

9. CONDITIONS

A. NGC will award the contract to the lowest evaluated and technically responsive bidder on overall basis.

B. The NGC / Employer have the right to reject all bids as per PPRA Rule # 33 (1) of Public Procurement Rules 2004.

C. Each page of the bidding documents / drawings shall be signed and stamped by the bidder.

10. The Bids prepared in accordance with the instructions in the Bidding Documents must reach at B-2, NTPS Colony T.M Khan Road, S.I.T.E Area Hyderabad - Pakistan on or before **10:00 hours**, Pakistan Standard Time **September 03rd, 2026**. The Technical Bids will be opened the same day at **11:30 hours** in the same Room. This advertisement is also available on PPRA website at www.ppra.org.pk

Executive Engineer, TLC Division,
EHV-II NGC of Pakistan Hyderabad
Mob. No. 0335-7401970
E-Mail: xentlc.ehv2@ntdc.com.pk

SECTION-I

INSTRUCTIONS TO BIDDERS

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INSTRUCTIONS TO BIDDERS

SECTION I

INSTRUCTIONS TO BIDDERS

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

A. GENERAL

IB.1 Scope of Bid

1.1 The Employer as defined in the Bidding Data hereinafter called "the Employer" wishes to receive bids for the construction and completion of works as described in these Bidding Documents, and summarized in the Bidding Data hereinafter referred to as the "Works".

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

IB.2 Source of Funds

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

IB.3 Eligible Bidders

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

a. Duly licensed by the Pakistan Engineering Council (PEC) in the category relevant to the value of the Works.
b. Duly prequalified/enlisted with the Employer.

IB.4 One Bid per Bidder

4.1 Each bidder shall submit only one bid either by himself, or as a partner in a joint venture. A bidder who submits or participates in more than one bid (other than alternatives pursuant to Clause IB.16) will be disqualified.

IB.5 Cost of Bidding

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

IB.6 Site Visit

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

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

B. BIDDING DOCUMENTS

IB.7 Contents of Bidding Documents

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

1. Instructions to Bidders.
2. Bidding Data.
3. Forms of Bids and schedules to bids
4. Conditions of Contract
5. Specifications - Technical Provisions.
7. Form of Bid & Appendices to Bid.
8. Bill of Quantities
9. Form of Bid Security.
10. Form of Contract Agreement.
11. Forms of Performance Security and Advance Guarantee/Bond.
12. Drawings.

7.2 The bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of bid submission will be at the Bidder's own risk. Pursuant to Clause IB.26, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.8 Clarification of Bidding Documents

8.1 Any prospective bidder requiring any clarification (s) in respect of the Bidding Documents may notify the Employer in writing at the Employer's address indicated in the Invitation for Bids. The Employer will respond to any request for clarification which he receives earlier than 10 days prior to the deadline for submission of bids.

Copies of the Employer's response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying its source.

IB.9 Amendment of Bidding Documents

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

9.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to 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.

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

C. PREPARATION OF BIDS

IB.10 Language of Bid

10.1 The bid and all correspondence and documents related to the bid exchanged by a bidder and the Employer shall be in the bid language stipulated in the Bidding Data and Particular Conditions of Contract. Supporting documents and printed literature furnished by the bidders may be in any other language provided the same are accompanied by an accurate translation of the relevant parts in the bid language, in which case, for purposes of evaluation of the bid, the translation in bid language shall prevail.

IB.11 Documents Accompanying the Bid

11.1 Each bidder shall:

(a) submit a written power of attorney authorizing the signatory of the bid to act for and on behalf of the bidder;

(b) update the information indicated and listed in the Bidding Data and previously submitted with the application for prequalification, and continue to meet the minimum criteria set out in the prequalification documents which as a minimum, would include the following:

(i) Evidence of access to financial resources along with average annual construction turnover;
(ii) Financial predictions for the current year and the two following years including the effect of known commitments;
(iii) Work commitments since prequalification;
(iv) Current litigation information; and
(v) Availability of critical equipment.

and

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

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

and other pertinent information such as mobilization programmeetc;

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

(a) the bid and in case of a successful bid, the Form of Contract Agreement shall be signed so as to be legally binding on all partners;
(b) one of the joint venture partners shall be nominated as being in charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;
(c) the partner-in-charge shall always be duly authorized to deal with the Employer regarding all matters related with and/or incidental to the execution of Works as per the terms and Conditions of Contract and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;
(d) all partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub-Para(b) above as well as in the Form of Bid and in the Form of Contract Agreement (in case of a successful bid); and
(e) a copy of the agreement entered into by the joint venture partners shall be submitted with the bid stating the conditions under which it will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partners without prior written consent of the Employer.

11.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the Bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.2 hereof.

IB.12 Bid Prices

12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause 1.1 hereof, based on the unit rates and / or prices submitted by the bidder.

12.2 The bidders shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by a bidder will not be paid for by the

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

IB.13 Currencies of Bid and Payment

13.1 The unit rates and the prices shall be quoted by the bidder entirely in Pak rupees. A bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country (referred to as the "Foreign Currency Requirements") shall indicate the same in Appendix-B to Bid. The proportion of the Bid Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements either (i) entirely in the currency of the Bidder's home country or, (ii) at the bidder's option, entirely in Pak rupees provided always that a bidder expecting to incur expenditures in a currency or currencies other than those stated in (i) and (ii) above for a portion of the foreign currency requirements, and wishing to be paid accordingly, shall indicate the respective portions in his bid.

13.2 The rates of exchange to be used by the bidder for currency conversion shall be the TT&OD Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date 28 days prior to the deadline for submission of bids.

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

IB.14 Bid Validity

14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the Date of Bid Opening specified in Clause IB.23.

14.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the bidders extend the period of validity for a specified additional period which shall in no case be more than the original bid validity period. The request and the responses thereto shall be made in writing. A bidder may refuse the request without forfeiting his Bid Security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.15 in all respects.

IB.15 Bid Security

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

15.2 The Bid Security shall be, at the option of the bidder, in the form of Deposit at Call or a Bank Guarantee issued by a Scheduled Bank in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank in Pakistan in favour of the Employer valid for a period 28 days beyond the Bid Validity date.

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

15.4 The bid securities of unsuccessful bidders will be returned as promptly as possible, but not later than 28 days after the expiration of the period of Bid Validity.

15.5 The Bid Security of the successful bidder will be returned when the bidder has furnished the required Performance Security and signed the Contract Agreement.

15.6 The Bid Security may be forfeited:

(a) if the bidder withdraws his bid except as provided in Sub-Clause 22.1;

(b) if the bidder does not accept the correction of his Bid Price pursuant to Sub-Clause 27.2 hereof; or

(c) In the case of successful bidder, if he fails within the specified time limit to:

(i) furnish the required Performance Security; or

(ii) sign the Contract Agreement.

IB.16 Alternate Proposals by Bidder

16.1 Should any bidder consider that he can offer any advantages 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.

16.2 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.17 Pre-Bid Meeting

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

17.2 The bidders are requested to submit questions, if any, in writing so as to reach the Employer not later than Seven (07) days before the proposed pre-bid meeting.

17.3 Minutes of the pre-bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents listed in Sub-Clause 7.1 hereof which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre-bid meeting.

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

IB.18 Format and Signing of Bid

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

18.2 All appendices to Bid are to be properly completed and signed.

18.3 No alteration is to be made in the Form of Bid nor in the Appendices thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the bid may be rejected.

18.4 Each bidder shall prepare by filling out the forms completely and without alterations one (1) original and number of copies, specified in the Bidding Data, of the documents comprising the bid as described in Clause IB.7 and clearly mark them “ORIGINAL” and ‘COPY” as appropriate. In the event of discrepancy between them, the original shall prevail.

18.5 The original and all copies of the bid shall be typed or written in indelible ink (in the case of copies, Photostats are also acceptable) and shall be signed by a person or persons duly authorized to sign on behalf of the bidder pursuant to Sub- Clause 11.1(a) hereof. All pages of the bid shall be initialed and stamped by the person or persons signing the bid.

18.6 The bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the Employer, or as are necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

18.7 Bidders shall indicate in the space provided in the Form of Bid their full and proper addresses at which notices may be legally served on them and to which all correspondence in connection with their bids and the Contract is to be sent.

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

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

19.1 Each bidder shall submit his bid as under:

(a) ORIGINAL and each copy of the Bid shall be separately sealed 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 19.2 hereof.

19.2 The inner and outer envelopes shall:

(a) be addressed to the Employer at the address provided in the Bidding Data;

(b) bear the name and identification number of the contract as defined in the Bidding Data; and

(c) provide a warning not to open before the time and date for bid opening, as specified in the Bidding Data.

19.3 In addition to the identification required in Sub-Clause 19.2 hereof, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared “late” pursuant to Clause IB.21

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

IB.20 Deadline for Submission of Bids

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

(b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of bids. No claims will be entertained for refund of such expenses.

(c) Where delivery of a bid is by mail 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.

20.2 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an amendment in accordance with Clause IB.9, in which case all rights and obligations of the

Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.21 Late Bids

21.1 (a) Any bid received by the Employer after the deadline for submission of bids prescribed in Clause IB.20 will be returned unopened to such bidder.

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

IB.22 Modification, Substitution and Withdrawal of Bids

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

22.2 The modification, substitution, or notice for withdrawal of any bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.19 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" as appropriate.

22.3 No bid may be modified by a bidder after the deadline for submission of bids except in accordance with Sub-Clauses 22.1 and 27.2.

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

E. BID OPENING AND EVALUATION

IB.23 Bid Opening

23.1 The Employer will open the bids, including withdrawals, substitution and modifications made pursuant to Clause IB.22, in the presence of bidders' representatives who choose to attend, at the time, date and location stipulated in the Bidding Data. The bidders' representatives who are present shall sign a register evidencing their attendance.

23.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.22 shall not be opened.

23.3 The bidder's name, total Bid Price and price of any Alternate Proposal(s), any discounts, bid modifications**,** substitution and withdrawals, the presence or absence of Bid Security, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening of bids.

23.4 Employer shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with the Sub-Clause 23.3.

IB.24 Process to be Confidential

24.1 Information relating to the examination, clarification, evaluation and comparison of bid and recommendations for the award of a contract shall not be disclosed to bidders or any other person not officially concerned with such process before the announcement of bid evaluation report which shall be done at least ten (10) days prior to issue of Letter of Acceptance. The announcement to all Bidders will include table(s) comprising read out prices, discounted prices,

price adjustments made, final evaluated prices and recommendations against all the bids evaluated. Any effort by a bidder to influence the Employer's processing of bids or award decisions may result in the rejection of such bidder's bid. Whereas any bidder feeling aggrieved may lodge a written complaint not later than fourteen (14) days after the announcement of the bid evaluation report; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

IB.25 Clarification of Bids

25.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any bidder for clarification of his bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause IB.28.

IB.26 Examination of Bids and Determination of Responsiveness

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

26.2 A substantially responsive bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required Bid Security; and (iv) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation. A material deviation or reservation is one (i) which affect in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the bidder's obligations under the Contract; or (iii) adoption/rectification whereof would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

26.3 If a bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

IB.27 Correction of Errors

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

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

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

27.2 The amount stated in the Form of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected Bid Price, his Bid will be rejected, and the Bid Security shall be forfeited in accordance with Sub- Clause 15.6(b) hereof.

IB.28 Evaluation and Comparison of Bids

28.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause IB.26.

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

(a) making any correction for errors pursuant to Clause IB.27;
(b) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Daywork; and
(c) making an appropriate adjustment for any other acceptable variation or deviation.

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

28.4 If the Bid of the successful bidder is seriously unbalanced in relation to the Employer's estimate of the cost of work to be performed under the Contract, the Employer may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the Performance Security set forth in Clause IB.32 be increased at the expense of the successful bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful bidder under the Contract.

F. AWARD OF CONTRACT

IB.29 Award

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

29.2 The Employer, at any stage of the bid evaluation, having credible reasons for or *prima facie* evidence of any defect in 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.

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

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

IB.31 Notification of Award

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

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

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

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

IB.32 Performance Security

32.1 The successful bidder shall furnish to the Employer a Performance Security in the form and the amount stipulated in the Bidding Data and the Conditions of Contract within a period of 14 days after the receipt of Letter of Acceptance.

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

IB.33 Signing of Contract Agreement

33.1 Within 07 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Employer will send the successful bidder the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.

33.2 The formal Agreement between the Employer and the successful bidder shall be executed within 07 days of the receipt of the Contract Agreement by the successful bidder from the Employer.

IB.34 General Performance of the Bidders

The Employer reserves the right to obtain information regarding performance of the bidders on their previously awarded contracts/works. The Employer may in case of consistent poor performance of any Bidder as reported by the employers of the previously awarded contracts, interalia, reject his bid and/or refer the case to the 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.

IB.35 Integrity Pact

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

IB.36 Instructions not Part of Contract

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

SECTION-II

BID DATA SHEET

BID DATA SHEET

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

IB 1.1	Name and address of the Employer: Name: **National Grid Company of Pakistan Limited (NGC) [***Formerly NTDC***]** Address: Executive Engineer, TLC Division, EHV-II, NGC of Pakistan, B-2, NTPS Colony T.M Khan Road S.I.T.E Area Hyderabad Telephone No. 92-22-9250133 Mobile No. 0335-7401970
IB 1.1	The bidding is open to National Competitive Bidding (NCB).
IB 1.1	The Name of NCB is:- Installation, Erection, Testing & Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II The identification no. of NCB is: **XEN-EHV-II-NGC-HYD-02-2026** The quoted price must correspond to full scope of work.
IB 2.1	Source of Funding: NGC
IB 3.1 (a)	The Invitation for Bids is open to all bidders in their sole capacity or as joint venture meeting the following requirements: i) The Bidder shall be duly licensed by the Pakistan Engineering Council (PEC) minimum in the relevant category or had applied for renewal of license before submission of its bid. In case of Joint Venture, all the partners shall be duly licensed by PEC and the sum total of the limit of construction cost permitted by the categories of the individual licensees shall not be less than limit of construction cost permitted by the category required here above. ii) The bidder shall be on Active Taxpayers List of the Federal Board of Revenue and relevant Provincial Revenue Authority. iii) The Bidder shall not be blacklisted by NGC/NTDC/WAPDA/DISCOs/any Government/Public department/Donor Agencies at the time of submission of bids. The Bidder should provide details of previous black listing, if any. An affidavit is to be provided by the Bidder that the Bidder is not black listed by NGC/NTDC/WAPDA/DISCOs/ Any Govt. /Public department/Donor Agencies at the time of submission of bids. Further, the bidder shall submit an undertaking along with his bid that he has read and accepts the provisions of NGC/NTDC Policy for Blacklisting of Contractors (copy of policy attached with the bidding documents). Non-submission of this undertaking may result in the rejection of the bid. The undertaking will subsequently become part of the Contract Agreement as well. [Note: NTDC's SOP for blacklisting of Contractors is available in NTDC website for information as to general mechanism. However, this will be strictly interpreted to the extent of the mechanism defined in PPRA Rules (revised 2021) and ITB 38 of Section-II (BDS) of this document.] iv) The bidder shall submit dully filled/complete Beneficial Ownership Declaration Performa as per S.R.O 592(I)/2022 available at https://www.ppra.org.pk/doc/sro592.pdf
IB 3.1(b)	**Qualification of the Bidders:** To be qualified for the award of a contract, the bidder shall meet the qualification criteria delineated herein below: **1. Contractual Experience:** The bidder as a main contractor (as single entity or as JV partner or approved subcontractor) must have substantially completed construction contract(s) of similar nature of following: a) The Bidder as main contractor (single entity or joint venture partner) have completed construction contract of at least one (01) No. 220kV or higher rating substation/ Power House Switchyard with similar scope of work within the last five (05) years. For the above or other contracts/sub-contracts executed during the period stipulated here above, the Bidder shall have a minimum construction experience, comprising of Civil Works, erection, testing and commissioning of at least one 220kV or higher rating Transmission Line Bay and one complete 220kV or higher rating Auto Transformer Bay.

Such substation/ Power House switchyard must have been operating successfully for at least two (02) years prior to deadline for submission of Bids.

If the Bidder has executed the above contract(s) as a JV partner, he must substantiate that he has carried out all the activities mentioned here above.

In case the bid is submitted by a joint venture, Lead Partner shall meet the above experience criteria. However, each partner, other than Lead Partner, shall have experience of execution of construction contracts of at least 132kV or higher rating substation/ Power House switchyard as main contractor or as approved subcontractor during last five (05) years.

The Bidder shall submit with the Bid evidence in this regard including inter alia copies (with English translation) of the contract agreement(s) and substantial completion certificate(s), Performance certificate duly notarized, for the contract(s).

b) The bidder shall have his own key construction and erection equipment in good working condition as listed hereunder:

Sr. No.	Equipment Type & Characteristics	Qty.
1	Vibrator	01
2	Flatbed Compactor	01
3	Scaffolding	02
4	Crane	01
5	Material Lift Mixture	02
6	Mechanical excavators	03
7	Trucks/Loaders	04
8	General tools for tube connection	03
9	Instruments for testing & commissioning of 220kV AIS plant including protection & signaling	01 Set
10	Standard Instruments for erection of AIS plant	01 Set
11	Gas filling plant	01
12	General tools for erection of 220kV Equipment	01 Set
13	Relevant T&P and machinery required for successful testing & commissioning completion of the work	As per requirement

The bidder shall have his own above required equipment duly supported with documentary evidence/catalogues/drawings for undertaking such like works in good working condition. Alternatively, if not so, the bidder will identify the confirmed source of the said machinery, T&P etc. along with documentary evidence/catalogues/drawings and shall provide necessary guarantee/surety that he will arrange the said equipment in good working condition through its own resources prior to start of stringing activity. The aforementioned documentary evidence shall be submitted with the bid.

2. <u>Key Personnel:</u>

The Bidder shall have the personnel for the key positions to be deployed meeting the following requirements: (Information to be submitted in Appendix PER Forms to Bid given in Section-III of the Bidding Documents)

Positions	Relevant Construction Experience (years)
Project Manager	07
Construction Manager	05
Site Engineer Electrical	05
Plant erectors	05
Testing & Commissioning Engineer	05

The above personnel shall be graduate professional engineers or equivalent.

The above personnel shall be graduate engineers or equivalent* *[Any relevant qualification may be specified depending upon the role of the person].*

** Note: The rejection of key personnel shall not result in rejection of the bid, however, bidder shall undertake to replace the key personnel with the acceptable to the Employer in case of award of contract.*

3. <u>Bidder's Financial Capability:</u>

The Employer will take into account the following criteria to verify the financial qualification of the Bidder.

i. The audited Financial "Standalone" Statements (Balance Sheet along with Notes, Profit & Loss Accounts and Cash Flow Statement) audited by Chartered Accountant for the last five (05) years shall be submitted by the Bidder. The Bidder's Financial Statements for the last One year of the audited accounts should show that it has positive "NET WORTH" calculated as a difference between total assets and total liabilities (Information to be submitted in prescribed Form QF-5 of Appendix-N to Bid given in Section-III of the Bidding Documents). In case of JV, each JV partner shall meet the aforementioned criteria.

ii. Minimum average annual turnover of PKR 9.00 Million calculated as best of three years total certified payments received for contracts in progress or completed, within the last 03 years. The average annual turnover may include turnover of affiliates and subsidiaries to the extent of shareholding percentage of the Bidding company provided the turnover is accrued from similar business activity as the Bidding company.
(Information to be submitted in prescribed Form QF-6 of Appendix-N to Bid given in Section-III of the Bidding Documents).

In case of JV, all the JV partners shall combinedly meet the requisite criteria with the lead partner and other partner(s) meeting not less than 40% and 25% respectively of the said criteria.

iii. The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, lines of credit (issued specifically for the project), and other financial means to meet the total cash flow demands of this contract which is being considered equal PKR 4 Million plus 25% of the Bidder's commitments for running contracts. (Information to be submitted in prescribed Form QF-7 of Appendix-P to Bid given in Section-III of the Bidding Documents).

Notes:

- In case of JV, all the JV partners shall combinely meet the requisite criteria with the lead partner and other partner(s) meeting not less than 40% and 25% respectively of the said criteria.

  The Bidder shall provide his current work commitments in form QF-4 of Appendix-P to Bid given in Section-III of the Bidding Documents.

- The Bidder shall provide his current work commitments in form specified in the Bidding Documents.

- The bidder shall provide bank certificate for his lines of credit on the prescribed Form specified in the Bidding Documents.

- [Note: Credit Lines submitted after opening of bids shall not be acceptable. Any withdrawal of the credit lines from the bidder's creditors during validity of bid shall be considered a withdrawal of bid.]

- The bidder shall provide bank certificate for his lines of credit on the prescribed Form QF-8 of Appendix-P to Bid given in Section-III of the Bidding Documents.

  In case of more than one Lot(s), Bidder is determined to be lowest evaluated substantially responsive in more than one Lot(s), qualification of the Bidder shall be assessed to meet the aggregate requirements for award of multiple Lots. [If, in this instant, the bidder qualifies for multiple Lots, Purchaser will have right to open price bids for all lots and consider most economical offer/bid/combination at its discretion].

4. Bidder's Litigation History:

Bidders are required to submit details of all litigation, arbitration and other claims whether pending, threatened or resolved in the last five years.

	The Employer may disqualify bidder in the event that the total amount of pending or threatened litigation, arbitration or other claims represents fifty percent (50%) of the Bidder's net worth. Details in this regard should be submitted in the prescribed Form QF-6 given in Appendix-G of Bidding Document. The Qualification of the Bidders will be based on meeting the pass/fail criteria as demonstrated by the Bidders' responses in the respective Appendices. The above stated requirements are the minimum and the Employer reserves the right to request for any additional information. The Employer also reserves the right to reject the proposal of any Bidder, if in the opinion of the Employer the qualification details are incomplete, ambiguous or the Bidder is found not qualified to satisfactorily perform the Contract. The above stated Appendices should be completed as per prescribed format and submitted along with required attachments. The missing or incomplete information/documents may render the bid substantially non-responsive. In this regard, the Employer does not have an obligation to request any document/certificates.
IB 3.2	The following sub clause is added after 3.1: A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if, including but not limited to: (i) they have controlling shareholders in common; or (ii) they receive or have received any direct or indirect subsidy from any of them; or (iii) they have the same legal representative for purposes of this bid; or (iv) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or (v) A Bidder or any affiliated entity, participated as a consultant in the preparation of the design or technical specifications of the plant and services that are the subject of the bid.
IB 6.1	The Bidder shall inspect the site, examine and obtain all information required and satisfy himself regarding matters and things such as access to site, communication, transport, right of way, the type and number of equipment and facilities required for the satisfactory completion of work, the quantity of various sections of the work, the availability of local labor, availability and rates of materials, local working conditions, uncertainties of weather, obstructions and hindrances that may arise etc., which may affect the work or cost thereof, before submission of his bid. Ignorance of site conditions shall not be accepted by the Employer as basis for any claim for compensation. The submission of a bid by the bidder will be construed as evidence that such an examination was made and any later claims/disputes in regard to rates quoted shall not be entertained or considered by the Employer.
IB 7.2	The Bidders should ensure that they have received the Bidding Documents including Addenda (if any) complete in all respects. The Employer accepts no responsibility for any Bidder lacking a complete set of Bidding Documents including Addenda (if any). The complete Bidding Document including Addenda (if any) will also be available on Employer's website i.e. www.ntdc.com.pk.
IB 8.1	The Sub-Clause 8.1 is amended to the following extent: No request for clarification will be entertained which will be received later than 10 days prior to the date fixed for submission of Bids. The Purchaser's response will be made not later than 7 days prior to the date fixed for submission of Bids. Further, the mere request for clarification from the bidders shall not be a ground for seeking extension in the deadline for submission of Bids.

IB 10.1	The bid with all accompanying documents and all communications in relation to or concerning the bidding Process shall be in **English** language and strictly on the forms provided in the bidding Documents. In case any of these Documents is in another language, it must be accompanied by an accurate translation of the relevant passages in English, in which case, for all purposes of interpretation of the bid, the translation in English shall prevail. Any portions of Bids that are not in English may not be evaluated. Failure to comply with this may disqualify a bid.
IB 11.1	**Documents Comprising the Bid** The Bid submitted by the Bidder shall be comprise of the following documents: a) Duly filled-in Form of Bid along with Appendices to Bid especially the following: (i) Schedule of Prices (ii) Bidder's Qualification Forms (iii) Bid Security as per IB Clause 15.1 (iv) Appendix-A to Bid Special Stipulations (v) Appendix-E to Bid Proposed Construction Schedule (vi) Appendix-F to Bid Method of Performing the Work (vii) Appendix-G to Bid Proposed Personnel (viii) Appendix-H to Bid List of Major Equipment-Related Items (ix) Appendix-J to Bid Organizational Chart of the Supervisory Staff and Labor (x) Appendix-N to Bid Deviations (xi) Appendix-O to Bid Integrity Pact (xii) Appendix-P to Bid Bidder's Qualification Forms b) Written Power of Attorney authorizing the signatory of the bid to act for and on behalf of the Bidder; c) Copies of Original Documents defining the constitution or legal status, place of registration and principal place of business of the bidder and JV partners; d) An affidavit that the Bidder has not been blacklisted pursuant to Sub-Clause 3.1(a)(iv); e) An Affidavit that the Bidder has read and accepts NGC/NTDC's SOP for blacklisting of Contractors pursuant to Sub-Clause 3.1(a)(iv) & ITB 38 of Bid Data Sheet of this document; f) Proof of purchase of Bidding Documents from the Employer; g) PEC license pursuant to Sub-Clause 3.1(i); h) Beneficial Ownership Declaration Performa dully filled by the Bidder as per S.R.O 592(I)/2022 available at https://www.ppra.org.pk/doc/sro592.pdf. i) Duly filled-in Form of Price Bid with following Appendices to Bid: i) Appendix-D to Bid Bill of Quantities ii) Appendix-M to Bid Estimated Progress Payments j) Any other document required to be submitted in accordance with these Bidding Documents.
IB 12.3	Add the following new Sub-Clause IB 12.3: The prices quoted by the bidder shall be firm and shall not be adjustable.
IB 13	Clause IB.13 is substituted with the following: "The unit rates and prices shall be quoted by the Bidder entirely in Pak Rupees. All payments under the contract shall be made in Pak Rupees only. Bidders expecting to incur expenditures in currency(ies) other than Pak Rupees shall manage foreign currency(ies) at their own arrangement. The exchange risk in this regard, if any, shall be deemed to be included in unit rates and prices quoted by the Bidder."

IB 14.1	The period for Bid validity shall be minimum Ninety (90) days after the date of Bid opening.
IB 15.1	The amount of Bid Security shall be an amount Rs. 600,000 on the prescribed format
IB 15.2	Sub-Clause IB.15.2 is substituted with the following: "The Bid Security shall be, at the option of the Bidder, in the form of Deposit at Call or a Guarantee issued by a Scheduled Bank in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank in Pakistan in favor of the Employer on the prescribed Form annexed to these Documents valid for a period 28 days beyond the Bid Validity date. The Bid Security of Joint Venture shall be in the name of Joint Venture submitting the Bid. For avoidance of doubt, a Bid Security issued by a foreign bank but not counter guaranteed by a Scheduled Bank in Pakistan shall not be acceptable and rejected as non-responsive." If a bidder submits a Bid Security that has following discrepancies (to the extent mentioned against each), the Procuring Agency shall request the Bidder to submit a complaint bid security within fourteen (14) days of receiving such request. Failure to provide a complaint bid security within the prescribed period of receiving such a request shall cause the rejection of the bid. Any bid accompanied by bid security with deviation greater than the extent mentioned below shall be rejected: i. Bid Security amount is short within 10% of Bid Security amount; and/or ii. Bid Security validity period is short by a maximum of two days Any changes with respect to format/text which does not hurt the right of employer for encashment of the guarantee and does not limit the obligation of the bidder as required in the Bidding Document/Bid Security Format.
IB 15.6	The following is added at the end of Sub-Clause IB.15.6: "(d) If the Bidder is found involved in corrupt and fraudulent practices."
IB 18.4	Sub-Clause 18.4 is substituted with the following: "Each Bidder shall prepare by filling out the forms completely and without alterations one original set of the Bid as described in IB. 11 and clearly mark "ORIGINAL BID". In addition, the Bidder shall submit one (01) copy of the Bid, clearly marked as "COPY NO 1 - BID". In the event of any discrepancy between the original and the copies, the original shall prevail. The Bidder shall also submit an electronic copy of BOQ on Pen Drive in MS Office (Excel) format and shall enclose in the Bid envelope."
IB.19.1	Sub-Clause 19.1 is substituted by the following: "The Bid (comprising the relevant documents as stated under Sub-Clause IB.11) shall be prepared separately. The ORIGINAL and each COPY of Bid shall be sealed in one envelope marked as such.The outer envelope shall be addressed/identified as given in Sub-Clause 19.2 hereof."
IB 19.2 (a)	Employer's address for the purpose of Bid submission: Executive Engineer, TLC Division, EHV-II, NGC of Pakistan, B-2, NTPS Colony T.M Khan Road S.I.T.E Area Hyderabad Telephone No. 92-22-9250133 Mobile No. 0335-7401970 Email xentlc.ehv2@ntdc.com.pk
IB 19.2 (b)	**Brief Description of Works** **Installation, Erection, Testing & Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II** Contract Identification No.: **XEN-EHV-II-NGC-HYD-02-2026**
IB 19.2 (c)	Para (c) of Sub-Clause 19.2 is substituted by the following: The outer envelopes and the inner envelopes containing the Bid shall bear a warning not to open before the time and date for the opening of Bids, in accordance with IB 23.1.
IB 20.1 (a)	**Deadline for Submission of Bid:** Date: **September 03rd, 2026** Time: **10:00 AM**

IB 20.1	Add the following new Para (d) at the end of Sub-Clause: "(d) Bids submitted through fax or email shall not be considered."
IB.23 23.1	**Bid Opening:** Sub-Clause IB.23.1 is substituted by the following: The Employer shall open the Bids in public at the address, on the date, and time specified herein in the presence of Bidder's designated representatives who choose to attend. The Bidders' representatives who are present shall sign a register evidencing their attendance. Time: **11:30 AM** Date: **September 03rd, 2026** Address: Executive Engineer, TLC Division, EHV-II, NGC of Pakistan, B-2, NTPS Colony T.M Khan Road S.I.T.E Area Hyderabad Telephone No. 92-22-9250133 Mobile No. 0335-7401970 Email xentlc.ehv2@ntdc.com.pk
23.2	The Bids will be opened on scheduled date and time in presence of the representative of the bidders who choose to attend. If the Bid is submitted unsealed or found unsealed inside the envelope, the Employer shall reject the entire Bid and record at the time of opening of the Bids.
23.3	First, envelopes marked "WITHDRAWAL" shall be opened, read out, and recorded, and the envelope containing the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out and recorded at bid opening.
23.4	Next, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing the Substitution Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Bid, if any, shall be opened, read out, and recorded. No envelope shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.
23.5	Next, outer envelopes marked "MODIFICATION" shall be opened. No Bid shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at the opening of Bids. Only the Bids, both Original as well as Modification are to be opened, read out, and recorded at the opening.
23.6	All other envelopes holding the Original Bids, except the Bids rejected pursuant to Sub-Clause IB.23.2, shall be opened one at a time, and the following read out and recorded. (a) the name of the Bidder; (b) whether there is a modification or substitution; (c) the Bid Prices, including any discounts, cross discounts and alternative offers; (d) the presence of Bid Security; and (e) any other details as the Employer may consider appropriate. Only Bids and alternative Bids (if allowed under Sub-Clause IB.16 hereof) read out and recorded at bid opening shall be considered for evaluation. Unless otherwise specified in the BDS, the Form of Bid is to be initialed by the nominated representatives of the Employer attending the bid opening. No Bid shall be rejected at the opening of Bids except for late bids, in accordance with IB.21.1.
23.7	The Employer shall prepare a record of the opening of Bids that shall include, as a minimum: the name of the Bidder, the Bid Price, any discounts, cross discounts, any alternative offers and presence of Bid Security. A copy of the record shall be distributed to all Bidders present at the time of Bid opening.
23.8	The Employer will notify Bidders in writing who have been rejected on the grounds of being substantially non-responsive to the requirements of the Bidding Documents and return their Bid Securities.
IB 24.2	Add the following new Sub Clause after IB 24.1: 24.2 Bidders and their respective agents, suppliers, sub-contractors, representatives and anyone else on behalf of the bidder will not communicate or attempt to communicate directly or indirectly with the Employer, including any employees, directors, officers, agents or representatives of any of them during any part of the Competitive Bidding Process, except as expressly directed or permitted by the Employer. Bidders will also not engage in any form of political or other lobbying whatsoever with respect to their Bids, or otherwise attempt to influence the outcome of the Competitive Bidding Process. In the event of any such communications or lobbying, Employer may at any time reject any Bid by that Bidder without further consideration.

IB 25.1	Add the following at the end of Sub-Clause 25.1: The Employer may, at his discretion, ask any Bidder for confirmation/submission of missing information to clarify its Bid. However, the Employer does not have an obligation to request any additional information or clarification with respect to missing or deficient information in a Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered.
IB 25.2	Add the following new Sub-Clause: 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 26.1	Sub-Clause 26.1 is substituted by the following: "The Employer will determine whether Bid is substantially responsive to the requirements of the Bidding Documents."
IB 26.2	Sub-Clause 26.2 is substituted by the following: "A substantially responsive Bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) meets the qualification criteria delineated at Sub-Clause IB.3A hereof;(iv) has been properly signed; (vi) is accompanied by the required Bid Security; and (vii) 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; or (iii) adoption/rectification whereof would affect unfairly the competitive position of other Bidders presenting substantially responsive bids. Any minor informality or non-conformity or irregularity in a Bid which does not constitute a material deviation may be waived by the Employer, provided such waiver does not prejudice or affect the relative ranking of any Bidder."
IB 26.4	Following Sub-Clauses are added at the end of Sub-Clause 26.3: The Employer may reject any Bid as non-responsive if found materially incomplete, obscure, irregular or omits any material information required to be submitted by the Bidding Documents.
IB 27.3	Following Sub Clause is added after Sub Clause 27.2: If as a result of arithmetic correction, the Bid Price is increased substantially, the Bidder may be asked to increase the amount of its Bid Security accordingly by submitting its amendment within fifteen (15) days from issuing date of such notification. If the Bidder fails to provide the requisite amendment of the Bid Security within the stipulated period, his Bid will be held substantially non-responsive and will be rejected.
IB 28.1	Following Para is added at the end of the Sub-Clause 28.1: "The Works will be evaluated and compared on Lot basis (if applicable)."
IB 28.2	Following Para is added after the Para (c) of IB. 28.2: (d) applying cross discount in case of combination of Lots to arrive at least cost combination
IB 28.4	Following is added at the end of Sub-clause IB 28.4: "or the employer may require the successful Bidder to balance his bid."
IB 28.5	Following new Sub Clause is added after IB 28.4: The Employer will evaluate the Bids, including all clarifications, additional information, modifications and negotiated changes, by applying the Eligibility and Qualification Criteria. Without limiting the particular criteria, the Employer may take into account the following in the Evaluation of Bids: i. Non-performance by a Bidder on previous contracts with Employer or others; ii. The quality of a Bidder's performance on previous contracts with Employer or others; iii. Anticipated or ongoing claims with or in connection with a Bidder; iv. Any security of safety concerns which Employer may have in respect of a Bidder or its facilities, subcontractors or suppliers; v. The results of any interview with a Bidder or supplied references: or vi. Any knowledge of or experience with a Bidder or its principals, directions, officers and employees.

	The Employer may independently verify any information (including conducting credit, reference and other checks with respect to a Bidder) and consider such findings in its evaluation. Employer is not required to inform Bidders of how Bids were ranked in the evaluation process.
IB 28.6	Add the following new Sub-Clause IB 12.5: The Employer's evaluation of a Bid will exclude and not take into account Provincial sales Tax (PST).
IB 29.1	Add the words "for the respective Lot(s)" after the words "evaluated Bid Price" in 3rd line of this Sub-Clause. Add the following at the end of this Sub-Clause: "Provided further in case a Bidder is determined to be the lowest evaluated substantially responsive in more than one Lot, the aggregate requirements delineated under Sub-Clause IB.3 hereof shall apply."
IB 29.2	Following text is added at the end of Sub Clause 29.2 The Employer reserves the right to assess the capacity and capability of the Bidder, to successfully execute the scope of work covered under the Bidding Documents within stipulated completion period. This assessment may interalia include for (i) document verification; (ii) details of work executed, work in hand, anticipated in future; (iii) details of tools & plant; (iv) availability of requisite key personnel (v) financial resources; (vi) details of quality system in place; (vii) past experience and performance; (viii) customer feedback (ix) Bank's feedback etc.
IB 30.1	The Employer reserves the right to reject any bid on the following accounts, apart from those mentioned in the bidding documents: i. Bidding Documents are not purchased by the bidder. ii. Bid is not received by the due date and time specified. iii. Cost of the bidding documents is not remitted. iv. Bid is not accompanied by Bid security as specified in the document; Bid security is inadequate; Bid guarantee is not in the specified format. v. Bid does not cover the complete scope of work. vi. Bid does not contain all required particulars as per Schedules & Forms prescribed in the bidding documents. vii. Deviations, conditionality or reservations have been introduced to any part of the bidding documents which may not be acceptable to the Employer in its sole discretion. viii. Bidder does not respond promptly and thoroughly to the request for supplementary information required for the evaluation of his Bid. ix. Bid does not meet minimum acceptable standards of completeness, consistency and detail. x. Bid received from any Black listed Firm / Contractor. If at any time it is found that a material misrepresentation of facts is made or uncovered; the information submitted by the bidder concerning his qualification was false and materially inaccurate or incomplete. If the bidder is the Lead Member of a consortium, then the entire consortium may be disqualified/ rejected.
IB 32.1	The Bidder shall furnish an unconditional Performance Security, equal to ten percent (10%) of the Contract Price in the form prescribed in the conditions of Contract within a period of 14 days after the issuance of Letter of Acceptance/Notice of Award.
IB 33	Text of Clause IB.33 is deleted and substituted as follows: Within seven (07) days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the successful bidder shall depute its representative duly authorized for formal signing of the Contract Agreement, Form of which is provided in the Bidding Documents.

Annexure - 1 to Bidding Data Sheet

FORMAT FOR POWER OF ATTORNEY FOR SIGNING OF BID

POWER OF ATTORNEY

Know all men by these presents, we _____(name and address of the registered office of the Bidder) do hereby constitute, appoint and authorize Mr. / Ms. _____R/o _____(name and address of residence) who is presently employed with us and holding the position of _____, as our attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to the bid of the (please state the name and address of the bidder) for Bidding Document No. **Tender No. XEN-EHV-II-NGC-HYD-02-2026: Installation, Erection, Testing & Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II** (the "tender"), including signing and submission of all documents and providing information / responses to National Grid Company of Pakistan [NGC] (Formerly NTDC), representing us in all matters in connection with our bid for the said tender.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and agree that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

For

(Signature)
(Name, Title, Email ID and Address)

Accepted
…….(Signature)
(Name, Title, Email ID and Address of the Attorney)

ACKNOWLEDGMENT

Before me, a Notary Public for and in the City of _____, this _____ of _____ 2026 personally came and appeared:

NAME IDENTIFICATION DOCUMENT
_____ _____

Known to me to be the same person/s who executed the foregoing Special Power of Attorney in favor of _____, and acknowledged to me the same is/are his/her/their free and voluntary act and deed.
IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal, the date and place above written.

NOTARY PUBLIC

Annexure - 2 to Bidding Data Sheet

A.FORM OF UNDERTAKING BY THE JOINT VENTURE PARTNERS

(On Company's Letter Head)

THIS JOINT DEED OF UNDERTAKING executed on this…… day of…….. Two Thousand and …….....by……. a company incorporated under the laws of ……and having its Registered Office at..... (hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s……a company incorporated under the laws of…… and having its Registered Office at…… (hereinafter called the "Party No.2" which expression shall include its successors, executors and permittedassigns) and M/s.. .. .. .a Company incorporated under the laws of…….. and having its Registered Office at……. (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract"{in case of award)] against the Identification No…….for _____ associated with _____ of ……. (hereinafter called the "**Employer**").

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated..... AND WHEREAS the Employer invited bids for the Dismantling of Erected Tower material stipulated in the Bidding Document under _____ _____ associated with _____.

AND WHEREAS Clause 2, Section-ITB and 'Qualification & Evaluation Requirement of the Bidder'(clause 13, 24 & 26 of ITB), and technical provisions forming part of the bidding documents, inter-alia, stipulates that an Undertaking of two or more qualified partners, meeting the requirements of 'Qualification & Evaluation Requirement of the Bidder', as applicable may bid, provided, the Joint Venture fulfills all other requirements under Clause 2, 13, 24 & 26 of ITB and in such a case, the Letter of Bids (Bid Form) shall be signed by the Partner –In Charge so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that this Undertaking shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No……..dated…... by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of Clause 2, 13, 24 & 26 (Section-ITB) has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

1. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s…… the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, Supply, and successful performance of the equipment in accordance with the Contract:

2. In case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(s) do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.

3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary

or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.

4. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims arising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.

5. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be as delineated in Annexure attached with this undertaking. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.

6. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Joint Venture, other than the express provisions of the Contract.

7. This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.

8. In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favour of the Employer in the currency/currencies of the Contract.

9. It is further agreed that this Deed of Undertaking shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Deed of Undertaking have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of ……. has been affixed in my/ our presence pursuant to Board of Director's Resolution dated …….	For Lead Partner (Party No.-1) For and on behalf of M/s ……..
Name ……..	
Designation …….	
Signature …….	(Signature of the authorized representative)
WITNESS :	
I. ……	
II. ……	

Common Seal of …….
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

WITNESS :

I. ……

II. ……

For Party No.-2
For and on behalf of M/s……..

(Signature of the authorized
representative)

Common Seal of …….
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

WITNESS :

I. ……

II. ……

For Party No.-3
For and on behalf of M/s.
……..

(Signature of the authorized
representative)

Notes:

1. In the event that the successful Bidder is a joint venture formed of two or more companies, the Employer requires that the parties to the joint venture accept joint and several liabilities for all obligations under the Contract.
2. The maximum number of J.V partners is three (03).

Annexure - 3 to Bidding Data Sheet

B.FORM OF LETTER OF INTENT BY JV PARTNERS TO ENTER INTO JV AGREEMENT

THIS LETTER OF INTENT signed on this……. day of…….. Two Thousand and …….....by……. a company incorporate under the laws of …… and having its Registered Office at..... (hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s……a company incorporatedunder the laws of…… and having its Registered Office at…… (hereinafter called the "Party No.2" which expression shall include its successors, executors and permitted assigns) and M/s.. .. .. a Company incorporated under the laws of …….. and having its Registered Office at……. (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" {in case of award)] against the Specification No…….for _____ associated with _____ of …….. (hereinafter called the "**Employer**").

WHEREAS the Party No.1, Party No.2 and Party No.3 intend to enter into a Joint Venture Agreement

AND WHEREAS the Employer invited bids as per the above mentioned Specification for the Dismantling of Erected Tower material stipulated in the Bidding Document under _____ associated with _____.

AND WHEREAS Clause 2, Section-ITB and 'Qualification & Evaluation Requirement of the Bidder'(clause 13, 24 & 26 of ITB), and technical provisions forming part of the bidding documents, inter-alia, stipulates that two or more qualified partners, meeting the requirements of Clause 2, Section-ITB and 'Qualification & Evaluation Requirement of the Bidder'(clause 13, 24 & 26 of ITB), as applicable may bid, provided, they submit a Letter of Intent to enter into Joint Venture Agreement and the Joint Venture Partners fulfill all other requirements under Clause 2, Section-ITB and 'Qualification & Evaluation Requirement of the Bidder'(clause 13, 24 & 26 of ITB), and technical provisions forming part of the bidding documents and in such a case, the Letter of Bid (Bid Form) shall be signed by all the proposed partners so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract by entering into Joint Venture Agreement as per proforma specified in this Section IV. Bidding Forms of the Bidding Documents which will be legally binding on all partners and all obligations hereunder.

The above clause further states that this Letter of Intent shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No……..dated….. by Party No.1 based on this Letter of Intent between all the parties; under these presents and the bid in accordance with the requirements of Clause 4.1, Section-ITB and 'Qualification Requirement of the Bidder', Section-Evaluation and Qualification Criteria, has been signed by all the parties.

NOW THIS UNDERTAKING WITNESSED AS UNDER:

In consideration of the above premises and agreements all the parties of this Letter of Intent do hereby declare and undertake:

1. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s…… the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, Supply, and successful performance of the equipment in accordance with the Contract for which we shall enter into Joint Venture Agreement as per proforma specified in this Section IV. Bidding Forms of the Bidding Documents which will be legally binding on all partners:

2. If the Contract is awarded to Joint Venture then in case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(s) will be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.

3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents will promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.

4. The financial liability of the Parties of the Deed of Undertaking to the Employer in the event of award of Contract on the Joint Venture, with respect to any of the claims rising out of the performance or non-performance of the obligations set forth in the Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of the Deed of Undertaking.

5. It is expressly understood and agreed between the Parties to this Letter of Intent that the responsibilities and obligations of each of the Parties shall be as delineated in Annexure attached with this Letter of Intent. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract in the event of award on Joint Venture.

6. It is also understood that this Letter of Intent is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Letter of Intent shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Letter of Intent or on the Joint Venture, other than the express provisions of the Contract.

7. This Letter of Intent shall be construed and interpreted in accordance with the provisions of the Contract.

8. In case of an award of a Contract, we the parties to this Letter of Intent do hereby agree that we shall enter into Joint Venture Agreement as per proforma specified in this Section IV. Bidding Forms of the Bidding Documents which will be legally binding on all partners and we shall be jointly and severally responsible for furnishing a Contract performance security from a bank in favour of the Employer in the currency/currencies of the Contract.

9. It is further agreed that this Letter of Intent shall be irrevocable and shall form an integral part of the bid. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Letter of Intent have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of ……. has been affixed in my/ our presence pursuant to Board of Director's Resolution dated …….	For Lead Partner (Party No.-1) For and on behalf of M/s ……..
Name …….. Designation …….	(Signature of the authorized representative)
Signature …….	
WITNESS :	

I. ……

II. ……

Common Seal of ……. has been affixed in my/ our presence pursuant to Board of Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

For Party No.-2
For and on behalf of M/s……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Common Seal of ……. has been affixed in my/ our presence pursuant to Board of Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

For Party No.-3
For and on behalf of M/s.
……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Notes:

1. In the event that the successful Bidder is a joint venture formed of two or more companies, the Employer requires that the parties to the joint venture accept joint and several liabilities for all obligations under the Contract.
2. The maximum number of J.V. partners is three (3).

SECTION-III

FORMS OF BID AND APPENDICES

Form of Bid

Bid Reference No. _____

_____

_____

(Name of Contract/Works)

To:

_____

_____

_____

We, the undersigned, declare that:

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract, Contract Data, Specifications, Drawings, if any, Schedule of Prices and Addenda Nos. _____ for the execution of the above-named Works, we, the undersigned, being a company doing business under the name of and address _____ _____ and being duly incorporated under the laws of Pakistan hereby offer to execute and complete such Works and remedy any defects therein in conformity with the said Documents including Addenda thereto for the Total Bid Price of Rs_____(Rupees_____) or such other sum as may be ascertained in accordance with the said Documents.
2. We Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of **90 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;
3. As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount of _____ _____ drawn in your favour or made payable to you and valid for a period of twenty eight (28) days beyond the period of validity of Bid.
4. We undertake, if our Bid is accepted, to commence the Works and to deliver and complete the Works comprised in the Contract within the time(s) stated in Contract Data.
5. We agree to abide by this Bid for the period of _____ days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
6. Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
7. We undertake, if our Bid is accepted, to execute the Performance Security referred to in Conditions of Contract for the due performance of the Contract.
8. We understand that you are not bound to accept the lowest or any bid you may receive.
9. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other person or persons making a bid for the Works.

Dated this_____day of _____, 2026

Name…….....

In the capacityof….....……

Signed…….....

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

Date..... .....

Address…….……..

Email……

Witness:

(Signature)_____
Name:_____

Address: _____
_____

APPENDIX – A TO BID

SPECIAL STIPULATIONS
Clause
Conditions of Contract

1.	Engineer's Authority to issue Variation in emergency	2.1	In accordance with National Grid Company of Pakistan (NGC) BOFP.
2.	Law Applicable	5.1(b)	The law to be applied is the law of Islamic Republic of Pakistan.
3.	Amount of Performance Security	10.1	10% of Contract Price stated in the Letter of Acceptance.
4.	Time for Furnishing Program	14.1	Within 30 days from the date of receipt of Letter of Acceptance.
5.	Minimum amount of third party Insurance	23.2	Rs. 1,000,000 (one million) per occurrence with number of occurrences unlimited.
6.	Time for Commencement	41.1	Within Seven (07) days from signing of the Contract Agreement.
7.	Time for Completion	43.1, 48.2	180 days from the date of Commencement.
8.	a) Amount of Liquidated Damages	47.1	0.25% for each day of delay in completion of the Works subject to a maximum of 10% of Contract Price stated in the Letter of Acceptance.
	b) Amount of Bonus	47.3	Not Applicable
9.	Defects Liability Period	49.1	180 Days from the effective date of Taking Over Certificate
10.	Percentage of Retention Money	60.2	10% of the amount of First and Final Invoice. 50% retention money/security will be released to the contractor after issuance of completion certificate and remaining 50% security will be released upon issuance of DLC certificate.
11.	Limit of Retention Money	60.2	10% of Contract Price stated in the Letter of Acceptance.
12.	Minimum amount of Interim Payment Certificates (Running Bills)	60.2	Not Applicable
13.	Time of Payment from delivery of Engineer's Interim Payment Certificate to the Employer.	60.10	Not Applicable
14.	Mobilization Advance * (Interest Free)	60.12	Not Applicable

Appendix-B to Bid

BILL OF QUANTITIES
A. Permeable

General

1. The Schedule of Quantities shall be read in conjunction with the Conditions of Contract, Specifications and Drawings. The Schedules do not generally give a full description of the Services to be performed under each item. Bidders shall be deemed to have read the Technical Specifications and other sections of the Bidding Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to include for the full scope as aforesaid, including overheads and profit.

2. If bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with IB 8 prior to submitting their bids.

3. The quantities given in the Schedule of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer and valued at the rates and prices entered in the priced Schedule of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix in accordance with provisions of the Contract.

4. The rates and prices entered in the priced Schedule of Quantities shall, except insofar as it is otherwise provided under the Contract include all costs of Contractor's plant, labor, supervision, materials, execution, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract. Furthermore, all duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to deadline for submission of Bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.

5. A rate or price shall be entered against each item in the priced Schedule of Quantities, whether quantities are stated or not. The cost of items against which the Contractor will have failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Schedule of Quantities.

6. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Schedule of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Works.

7. General directions and description of work and materials are not necessarily repeated nor summarized in the Schedule of Quantities. References to the relevant sections of the Bidding Documents shall be made before entering prices against each item in the priced Schedule of Quantities.

8. Provisional sums if included and so designated in the Schedule of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with Conditions of Contract.

Units & Abbreviations

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

10. The following abbreviations shall be used in the Price Schedules:

Abbreviation

Pakistani Rupees	PKR
Number	No.
Kilometre	km
Kilogram	kg
Cubic Meter	Cu.m
Provisional Sums	PS
Percent	%
Quantity	Qty

Pricing

11. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Bidder.
12. As specified in the Bid Data Sheet prices shall be subject to adjustment in accordance with the corresponding Appendix-E to Price Bid (Price Adjustment) to the Contract Agreement.
13. For each item, bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules. Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements), Technical Specifications, Drawings or elsewhere in the Bidding Documents.
14. The TOTAL for each Schedule and TOTAL of the Grand Summary shall be deemed to be the total price for executing and completing the Facilities in accordance with the Contract, whether or not each individual item has been priced.
15. When requested by the Employer for the purposes of making payments or part payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.
16. Except as otherwise expressly provided under the Conditions of Contract, the unit rates and lump sum amounts entered in the Price Schedules will be the rates at which the Contractor will be paid, and shall be deemed to include for the full scope and all costs incurred by the Contractor in the performance of the Facilities, the provision of services including his overheads, income tax, super tax, other indirect costs, profits and costs of accepting the general risks, liabilities and obligations set forth or implied in the Contract, except for such costs which are specified as reimbursable under the Contract.
17. Arithmetic errors will be corrected by the Employer as per ITB 31.
18. Price of any other item not specifically covered in the Price Schedules but is required for the completion, commissioning and operation of the overhead transmission line shall be deemed to be included in the Schedule of Quantities.
19. The Contractor of any Lot may be required by the Engineer/Employer to carry out foundation /installation work on any location falling in any other Lot.
20. The Contractor shall take all the safeguards at site for safety/security of men, material and machinery at his own responsibility and cost.

SCHEDULE OF PRICES / BILL OF QUANTITIES (BOQ)

Installation Testing and Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II						
SCHEDULE – 1						
Sr. No.	**Descriptions of Item/work**		**Unit**	**Quantity**	**Unit Rate**	**Total Amount (Rs.)**
1	**2**		**4**	**5**	**6**	**(7=5X6)**
A	**Transportation**					
1	Carriage including Loading/ Unloading of 160 MVA 220 / 132 kV transformer Main body to be shifted filled with oil to 220 kV Grid Station NGC Jhampir-II from 220 kV Grid station NTDC TM Khan Road or any other designated NGC Store.		Lot	1		
2	Carriage including Loading and Unloading of Oil containers, conservator tank, radiators, colling fans etc to 220 kV Grid Station NGC Jhampir-II from 220 kV Grid station NTDC TM Khan Road or any other designated NGC Store .		Lot	1		
3	Safe Handling, Loading transportation/ shifting and Unloading of Control cables, Connectors, Disc Insulators, Conductor from NTDC designated warehouse/stores along with all allied accessories to 220 kV Grid Station NGC Jhampir-II.		Lot	1		
4	Safe Handling, Loading transportation/ shifting and Unloading of Lightening Arrestor (Surge Arrestor) 198 KV with Bushing and surge counter along with SSS Height from NTDC designated warehouse/stores along with all allied accessories to 220 kV Grid Station NGC Jhampir-II.		Nos	3		
5	Safe Handling, Loading transportation/ shifting and Unloading of Lightening Arrestor (Surge Arrestor) 120 KV with Bushing and surge counter along with SSS Height from NTDC designated warehouse/stores along with all allied accessories to 220 kV Grid Station NGC Jhampir-II.		Nos	3		
	Sub-Total A:					
B	**Foundations / Civil Works**					
1	Clearing and grubbing of the complete site area for bushes, vegetation trees, roots and weeds etc. as per Drawings and Specifications and as directed by the Engineer including dismantling of old civil works if any disposal of debris away from site.		Lot	1		
2	Supply and installation of PVC conduits 50mm dia for carrying miscellaneous cables from cable trenches to equipment's as specified and as directed by the Engineer. (If required)					
	i	50mm dia (2inch) along with accessories (i.e. bends, joints)	Li.m	75		
	ii	100mm dia (4inch) along with accessories (i.e. bends, joints)	Li.m	50		
	iii	150mm dia (6inch) along with accessories (i.e. bends, joints)	Li.m	25		
3	Any Civil Work (including Trench Work), Mechanical and electrification works required in control House Building, 220 / 132 kV Switchyard & Metering Room		Lot	1		
	Sub-Total B:					

C	**Installation & Erection**				
1	**<u>160 MVA 220 / 132 kV Autotransformer</u>** Assembly, Erection, installation, fabrication (if any), Commissioning, Vacuuming oil dehydration of 220/132 /11 kV, 3 Phase 160 MVA Auto Transformer with all accessories and associated works including main Dia connection using AI Pipe / bundle conductor & hardware connectors, neutral/tertiary grounding system arrangements (PVC embedded for neutral bushing connection along with neutral busbar including supply of material) terminal connectors for connection with Hawthorn conductor (2x600 mm2) on HV/LV side, on load tap changer (MR Germany or equivalent), all other allied accessories as per NTDC specifications. Installation, Erection, cable laying, interconnection connection, of all secondary equipment along with their schemes including marshalling kiosks, Control Panels, Protection Panels, Synchronizing Panel, Event Recorder Panel, Fault Recorder Panel, AC/DC Auxiliary Supply Panels, Parallel Operation of 220 / 132 kV transformers & cable laying, interconnection connection of relevant switchyard Dia equipment & related protection/control schemes (i.e Autotransformer, CTs, Pts Circuits) also establishing communication between protection system and BCU. All wiring work shall be completed using necessary numbering/ferrules, steel cables glands, steel pipe supports, cable tags, cable ties, numbering tag, PVC piping for covering all cables, HT insulation tape, and all other related cable terminations and installation material as per specification and drawings. Temperature and oil level gauges calibration and preparation of as built drawings of all above works is also included in this scope. Commissioning and Testing of Autotransformer, including complete functional testing, pre-commissioning and commissioning tests, electrical and mechanical checks, transformer oil sampling and testing, insulation resistance and winding resistance tests, turns ratio/vector group verification, dielectric/BDV testing of insulating oil, operation and functional checks of all associated protection, control, alarm, indication and auxiliary systems, and all other tests, inspections and checks as recommended by the manufacturer, applicable IEC standards and the Employer, as necessary to establish the satisfactory condition, performance and readiness of the Autotransformer for safe energization and operation, complete in all respects.	No.	1		
2	**<u>Surge Arrestors</u>** Assembly, erection, installation of 220 & 132 kV, single pole, Surge Arrestor along with steel supporting structure and all accessories and associated work including main bay connections using Al pipe/bundle conductor also with main earthing mash and risers as per NGC technical specifications	No.	6		
3	Installation, erection, commissioning of any other equipment not mentioned above but deemed necessary for proper operation of the plant (If Required)	Lot	1		
	Sub-Total C:				
Total Schedule 1 (A+B+C)					

Note:

1. The quantities given in the BOQ are tentative/estimate and shall be finalized by Engineer according to the site requirements and may increase or decrease. The payment shall be made for actual quantities according to unit rates given in BOQ.
2. During construction, contractor will ensure safety to his workers/labours and any other material.
3. The above shall be carried out strictly in accordance with Technical Specifications.

_____
Name & Seal of Bidder

ABSTRACT OF COST

Sr. No	Description	Amount (Rs.)
Schedule 1	Installation Testing and Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II	
	Sub-Total	
	Sales/Service Tax	
	Total (inclusive of all taxes)	

Sign & Stamp

Appendix-D to Bid

Sheet 1 of 2

PROPOSED CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 43.1 of the General Conditions of Contract, the Works shall be completed on or before the date stated in Appendix-A to Bid. The Bidder shall provide as Appendix-E to Bid, the Construction Schedule in the bar chart (CPM, PERT or any other form) showing the sequence of work items and the period of time during which he proposes to complete each work item in such a manner that his proposed program for completion of the whole of the Works and parts of the Works may meet Time for Completion given in Appendix-A to Bid. It shall include but not limited to the following:

Sr. No.	Description of Work	Period in days from the effective date of contract
1.	Establishment of site office	
2.	Shifting & Transportation of Material	
	a) Commencement	
	b) Completion	
3.	Installation and Erection	
	a) Commencement	
	b) Completion	
4.	Interfacing and Stringing	
	a) Commencement	
	b) Completion	
5.	Testing & Commissioning	
	a) Commencement	
	b) Completion	

To provide the accumulative effective of the activities per month, the bidder shall also provide the graph/ chart as following:

Sr. No.	Description	Days				
1.	Signing of contract	**15**	**30**	**60**	**90**	**120**
2.	Effective Date					
3.	Mobilization					
4.	Transportation					
5.	Installation & Erection					
6.	Interfacing & Stringing					
7.	Testing & commissioning					

The proposed program of Works shall base on the Schedule of Implementation (60 days) as per Bidding Documents.

Note: The bidder shall also indicate the construction crews employed to achieve the completion target for the following:

Type of Crews	No. of Crew employed	Expected Progress/month/crew*
Erection Crew		
Dismantling Crew		
Interfacing & Stringing Crew		

*Mention the required time per tower of a crew to complete a certain activity e.g., foundation & dismantling etc.

Appendix-E to Bid

METHOD OF PERFORMING THE WORK

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

1. Organization Chart indicating head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.

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

3. The method of executing the Works comprising transportation of Plant and other materials from the Employer's designated storage yard to the site, civil works, erection works and testing & commissioning.

4. The Bidder shall include in his proposal the Quality Assurance Program containing the overall quality management and procedures which he proposes to follow in the performance of the Contract.

5. The Bidder shall also give details of the construction crews which he proposes to employ for each activity i.e., transportation of Plant and other materials from the Employer's designated storage yard to the site, civil works, erection works and testing & commissioning to achieve the Completion Time as per the following format:

Activity	**Duration**	**No. of Crews employed**	**Expected Progress per month per crew**

Appendix-F to Bid

Personnel

Form PER – 1: Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements for each of the positions listed in Section 2. The data on their experience should be supplied using the Form below for each candidate.

1.	**Title of position**
	Name
2.	**Title of position***
	Name
3.	**Title of position***
	Name
4.	**Title of position***
	Name
5.	**Title of position***
	Name

Form PER – 2: Resume of Proposed Personnel

The Bidder shall provide all the information requested below. Fields with asterisk (*) shall be used for evaluation.

Position*		
Personnel information	**Name**	**Date of birth**
	Professional qualifications	
Present employment	**Name of employer**	
	Address of employer	
	Telephone	**Contact (manager / personnel officer)**
	Fax	**E-mail**
	Job title	**Years with present employer**

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From*	To*	Company, Project, Position and Relevant Technical and Management Experience*

Appendix-G to Bid

EQUIPMENT

Form EQ – 1: List of Major Equipment – Related Items

The Bidder will provide on Sheet 2 of this Appendix a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment which shall be in sufficient detail to demonstrate fully that the equipment will meet all requirements of the Specifications.

The bidder must have the following equipment along with the minimum mentioned quantities as given below for the execution of the project:

Sr. No.	Equipment Type & Characteristics	Qty.
1	Vibrator	01
2	Flatbed Compactor	01
3	Scaffolding	02
4	Crane	01
5	Material Lift Mixture	02
6	Mechanical excavators	03
7	Trucks/Loaders	04
8	General tools for tube connection	03
9	Instruments for testing & commissioning of 220kV AIS plant including protection & signaling	01 Set
10	Standard Instruments for erection of AIS plant	01 Set
11	Gas filling plant	01
12	General tools for erection of 220kV Equipment	01 Set
13	Relevant T&P and machinery required for successful testing & commissioning completion of the work	As per requirement

Form EQ – 2: 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						

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Contractor in accordance with Clause 34 of the Conditions of Contract shall provide description of his construction camp's facilities and staff housing requirements.

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

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

1. Site Preparation (clearing, land preparation, etc.).
2. Provision of Services.
   a) Power (expected power load, etc.).
   b) Water (required amount and system proposed).
   c) Sanitation (sewage disposal system, etc.).
3. Construction of Facilities
   a) Contractor's Office. Workshop and Work Areas (areas required and proposed layout, type of construction of buildings, etc.).
   b) Warehouses and Storage Areas (area required, type of construction and layout).
   c) Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction, etc.).
4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).
5. Other Items Proposed (Security services, etc.).
6. Detail of testing Lab with testing equipment etc.

Appendix-I to Bid

ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOR

The Bidder shall provide Organization Chart for the supervisory staff and labor hereunder which shall meet the requirements of each construction activity. For this purpose, the Bidder shall ensure that he shall at least deploy the following personnel for the key positions for each Lot meeting the experience requirements as listed out hereunder:

Positions	Relevant Construction Experience
Project Manager	07
Construction Manager	05
Site Engineer Electrical	05
Plant erectors	05
Testing & Commissioning Engineer	05

The above personnel shall be graduate engineers registered with Pakistan Engineering Council or equivalent.

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**

Appendix-K to Bid

SOURCES OF MATERIAL
LIST OF MATERIALS LIKE CEMENT, REINFORCING STEEL

The bidder shall list in this Schedule the names of materials forming part of tower foundations such as cement, reinforcing steel which he intends to procure in connection with this Contract along with the names and complete addresses of the sources.

Name of Goods/Material/ Equipment	Name of Factory	Address

Use additional sheets if required.

Appendix-L To Bid

ESTIMATED PROGRESS PAYMENTS

Bidder's estimate of the value of work which would be executed by him during each of the periods stated below, based on his Program of Works and the Rates in the Schedule of Prices,

Period	**Amounts (Rs.)**
1st Month	
2nd Month	
3rd Month	
4th Month	
Total Bid Price	

Initials of Signatory to Bid: ……

Appendix-M to Bid

DEVIATIONS

Form D1-Deviations from Contractual Conditions

Deviations if any, which the bidder has taken to the Contractual Conditions in preparation of his bid, must be listed below.

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

Note: Attach additional sheets, if necessary.

Form D2-Deviations from Technical Conditions

Deviations if any, which the bidder has taken to the Technical Provisions in preparation of his bid, must be listed below.

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

Note: Attach additional sheets, if necessary.

Appendix-O 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]

Appendix-P to Bid

BIDDER'S QUALIFICATION FORMS

QF-1	General Information
QF-2	Construction Experience
QF-3	Performance Certificate
QF-4	Current Contract Commitments
QF-5	Financial Data
QF-6	Annual Turnover Data
QF-7	Financial Resources
QF-8	Bank Certificate
QF-9	Pending Litigation

Note:-

1. These forms shall be filled up and furnished by the Bidder and its Joint Venture partner(s), if any.
2. If necessary, additional sheets may be added to the forms. Each page of each form should be clearly marked in the right top corner as follows: Form QF1, page 1; Form QF1, page 2, etc.
3. Some forms will require attachments. Such attachments should be clearly marked as follows: Attachment 1 to Form QF1, Attachment 2 to Form QF1, etc.

Form QF-1: General Information

Bidder and its Joint Venture Partner(s) and/or Subcontractors are requested to complete the information in this form. Nationally information of Bidders should also be provided.

1.	Name of Bidder	
2.	Head office address	
3.	Local office address (if any)	
4.	Telephone	Contract
5.	Facsimile	e-mail
6.	Place of incorporation/registration	Year of incorporation/registration
7.	Main lines of Business 1. 2. 3. 4.	 Since: Since: Since: Since:

Note:
Copies of following credentials shall be attached:

(a) Copy of incorporation/registration certificate
(b) Organization chart
(c) PEC registration certificate in the appropriate category

Signature and Seal of Bidder:

Form QF-2: Construction Experience

Note: To be filled in accordance with criteria described in clause IB3.1 (b) Section-II of the bidding documents

(For a period of Last 10 Years)

Name of the Project: ……..

Order Placed by (full address of Employer)	Order No. and date	Description of Works	Value of order	Date of completion as per contract	Date of actual completion	Remarks indicating reasons for late completion, if any	Has the project been running satisfactorily ? (Attach a certificate from the Employer)	Contact person along with Telephone No., Fax No. and email address

Signature and Seal of the Bidder……

Place:

Date:

Form QF-3: Performance Certificate

(To be issued on the Letter Head of Issuing Authority)

It is to certify that M/s._____ has conducted the following works against mentioned project.

Sr.No.	Contract No. & Date	Designation & address of order placing authority/User	Name of Project	Description of Works	Date of Completion	Work Performance

The above services/Works have been performed against our Project and their performance is found satisfactory.

Date of issuing _____

Signature of issuing authority with seal
Name and designation of issuing authority
Address along with Email, Phone No. and
Fax of issuing authority

Note:

i. In case of those bidders who have provided services to NTDC shall furnish the details of such works in the above Performa which shall be signed by their authorized signatory along with seal and certificate is not required from the Employer in this respect.

ii. In case the performance certificate is not verifiable through the given contact address and email, the bid may be rejected.

Form QF-4: Current Contract Commitments

Bidders should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Sr. No.	Particulars of works executed	Contract No. & Date	Name of Contract placing Authority	Ordered Value (PKR)	Value of balance work (PKR)
1	2	3	4	5	6
2					
3					
4					
5					
6					
7					

Signature & Seal of the bidder:

Form QF-5: Financial Data

Financial Data for Previous 3 Years			
Particular			
Total Assets			
Total Liabilities			
Net Worth			
Current Assets			
Current Liabilities			
Information from Income Statement			
Total Revenues			
Profits Before Taxes			
Profits After Taxes			
Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last three years, as indicated above, complying with the following conditions.			
• All such documents reflect the financial situation of the Bidder and not sister or parent companies. • Historic financial statements must be audited by a certified accountant. • Historic Financial statements must be complete, including all notes to the financial statements. • Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).			

Signature and Seal of the bidder:

Form QF-6: Annual Turnover Data

Name of Bidder/Joint Venture Partner:

Bidder and its Joint Venture Partner(s) are requested to complete the information in this form separately. The information supplied should be the annual turnover of the Bidder, in terms of the amounts billed to clients for each year for work in progress or completed. In case of a joint venture, a copy of the Joint Venture Agreement must be attached. The Average Annual Turnover may include turnover of affiliates and subsidiaries to the extent of shareholding percentage of the Bidding company provided the turnover is accrued from similar business activity as the Bidding company. Average Annual Turnover will be considered on "Net Sales" i.e. without Sales tax, discounts etc.

Use a separate sheet for bidder and its Joint Venture partner(s).

Annual turnover data for the following last three fiscal years			
Year	**Amount Currency**	**Exchange Rate**	**Equivalent Amount (in the currency of Bid)**
		Average Annual Turnover	

Signature and Seal of Bidder:

Form QF-7: Financial Resources

Specify proposed sources of financing, such as liquid assets, lines of credit, and other financial means, available to meet the total construction cash flow demands of the subject contract.

Financial Resources		
Sr. No.	Source of Financing	Amount
1.		
2.		
3.		
4.		

Signature and Seal of Bidder:

Form QF-8: Bank Certificate

This is to certify that M/s…… is a reputed company with a good financial standing.

If the contract for the work, namely,…… is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs…… to meet their working capital requirements for executing the above contract.

Signature of Senior Bank Manager:_____
Name of the Senior Bank Manager:_____
Address of the Bank:_____

Stamp of the Bank

Note: Certificate should be on the letter head of the bank.

- **Change the text as follows for Joint Venture:**

This is to certify that M/s……..…… who has formed a JV with M/s……and M/s……..for participating in this bid, is a reputed company with a good financial standing.

If the contract for the work, namely…… is awarded to the above Joint Venture, we shall be able to provide overdraft/credit facilities to the extent of Rs…… to M/s…….. to meet the working capital requirements for executing the above contract.

[This should be given by each of the JV members in proportion to their financial participation.]

Form QF-9: Pending Litigation

Each Bidder or member of a JV must fill in this form

Pending Litigation					
Year	Name of Other Party(s)	Matter of Dispute	Litigation where (Court/ arbitration)	Amount involved	Value of pending claim as a %age of net worth

Signature and Seal of the bidder:

Appendix-Q to Bid

UNDERTAKING OF BID SECURITY
(To be Submitted on a Non-Judicial Stamp Paper)

We _____ (name of Bidder) undertake that Bid Security in accordance with Clause IB-19 of the bidding document is enclosed with our Price bid.

Signature and Seal of the Bidder:

Form QF-4: Pending Litigation

Each Bidder or member of a JV must fill in this form

Pending Litigation					
Year	Name of Other Party(s)	Matter of Dispute	Litigation where (Court/ arbitration)	Amount involved	Value of pending claim as a %age of net worth

Signature and Seal of the bidder:

STANDARD FORMS

FORM OF BID SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____

(Letter by the Guarantor to the Employer)

Name of Guarantor (ScheduledBank in Pakistan) 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 anddated 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 of twenty eight (28) days beyond the period of validity of the bid;
(2) that in the event of;

(a) the Principal withdraws his Bid during the period of validity of Bid, or

(b) the Principal does not accept the correction of his Bid Price, pursuant to Sub-Clause 16.4 (b) of Instructions to Bidders, or

(c) failure of the successful bidder to

(i) furnish the required Performance Security, in accordance with Sub-Clause IB-21**.**1 of Instructions to Bidders, or

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

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

NOW THEREFORE, if the successful bidder shall, within the period specified therefore, on the prescribed form presented to him for signature enter into a formal Contract Agreement with the said Employer in accordance with his Bid as accepted and furnish within fourteen (14)days of receipt of Letter of Acceptance, a Performance Security with good and sufficient surety , as may be required, upon the form prescribed by the said 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 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 bounded Guarantor has executed the instrument under its seal on the date indicated above, the name and seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name, Title & Address)

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

Corporate Guarantor (Seal)

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____

(Letter by the Guarantor to the Employer)

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

Name of Principal (Contractor) with address:_____
_____

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

Letter of Acceptance No._____Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the 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 the said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 9, Remedying Defects, of Conditions of Contract are fulfilled.

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

We, _____ (the Guarantor), waiving all objections and defenses under the Contract, do hereby irrevocably and independently guarantee to pay to the 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, for 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 bounded Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

1. _____

_____
Corporate Secretary (Seal)

2. _____

_____
(Name, Title & Address)

1. Signature _____

2. Name _____

3. Title _____

_____
Corporate Guarantor (Seal)

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the _____ day of _____ 20 _____ between _____(hereinafter called the "Employer") of the one part and _____ (hereinafter 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 Letter of Acceptance;
   (b) The completed Form of Bid along with Schedules to Bid;
   (c) Conditions of Contract & Contract Data;
   (d) The priced Schedule of Prices;
   (e) The Specifications; and
   (f) 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 within 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
_____
(Seal)

Signature of the Employer
_____
(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:

_____

(Name, Title and Address)

Witness:

_____

(Name, Title and Address)

FORM OF BANK GUARANTEE FOR ADVANCE PAYMENT

Guarantee No._____

Executed on_____

(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 Rs._____ Rupees _____) which amount shall be advanced to the Contractor as per provisions of the Contract.

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

AND WHEREAS _____ (Scheduled Bank) (hereinafter called the Guarantor) at the request of the Contractor and in consideration of the 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 (Scheduled Bank)

Witness:

1. _____

_____

Corporate Secretary (Seal)

2. _____

_____

(Name, Title & Address)

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

_____

Corporate Guarantor (Seal)

SECTION-IV

GENERAL CONDITIONS OF CONTRACT

SECTION-IV GENERAL CONDITIONS OF CONTRACT

This bidding document follows the FIDIC conditions of contract for construction works. The Conditions of Contract Comprise of two Sections: Section-IV – General Conditions of Contract, and Section-V – Special Conditions of Contract.

All the general Conditions shall be as per the FIDIC documents indicated below. These shall be read along with the Particular Conditions of Contract for interpretation. In case of any discrepancy between these General Conditions of Contract and the Particular Conditions of the Contract of Section-V, the provisions under the latter shall govern.

FIDIC FEDERATION INTERNATIONALE DES INGENIEURS – CONSEILS

CONDITIONS OF CONTRACT FOR WORKS OF CIVIL ENGINEERING CONSTRUCTION

FOURTH EDITION 1987

Reprinted 1988 with editorial amendments
Reprinted 1992 with editorial amendments

SECTION-V

SPECIAL CONDITIONS OF CONTRACT

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SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS OF CONTRACT

(Mandatory Provisions not to be Amended / Substituted except as instructed by PEC)

1.1 Definitions

(a) (i) The Employer is: National Grid Company of Pakistan Limited (NGC) [*Formerly NTDC*]

(a) (iv) The Engineer is: **Executive Engineer, TLC Division**,
EHV-II, NGC of Pakistan,
B-2, NTPS Colony T.M Khan Road S.I.T.E Area Hyderabad
Telephone No. 92-22-9250133 Mobile No. 0335-7401970
E-mail address: xentlc.ehv2@ntdc.com.pk

or any other competent person appointed by the Employer, and notified to the Contractor, to act in replacement of the Engineer. Provided always that except in cases of professional misconduct, the outgoing Engineers is to formulate his certifications/recommendations in relation to all outstanding matters, disputes and claims relating to the execution of the Works during his tenure.

(a)(vi) The following sub-clause 1.1 (a)(vi) is added after sub-clause 1.1(a)(v):

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

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

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

(b)(ix) The following sub-clause 1.1(b)(ix) is added at the end of sub-clause 1.1(b)(viii):

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

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

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

2.1 Engineer's Duties and Authority

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

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

(i) Consenting to the sub-letting of any part of the Works under Sub-Clause 4.1 "Subcontracting".

(ii) Certifying additional cost determined under Sub-Clause 12.2 "Not Foreseeable Physical Obstructions or Conditions".

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

(iv) Any action under Clause 40 "Suspension".

(v) Any action under Clause 44 "Extension of Time for Completion".

(vi) Any action under Clause 47 "Liquidated Damages for Delay" or Payment of Bonus for Early Completion of Works (PCC Sub-Clause 47.3).

(vii) Issuance of "Taking over Certificate" under Clause 48.

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

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

(ix) Fixing rates or prices under Clause 52.

(x) Extra payment as a result of Contractor's claims under Clause 53.

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

(xii) Issuance of "Final Payment Certificate" under Sub-Clause 60.8.

(xiii) Any change in the ratios of Contract currency proportions and payments thereof under Clause 72 "Currency and Rate of Exchange".

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

* (If in the opinion of the Engineer an emergency occurs affecting the safety of life or of the Works or of adjoining property, the Engineer may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.)

2.3 Engineer's Authority to delegate:

The following paragraph is added:

The Chief Engineer (SS Design) shall act as representative of Employer for providing in house Engineering Services including but not limited to the following:

a) Preparation of electrical & Erection works drawings/design
b) Interpretation of the bidding documents
c) Site visits for attending any technical problem if necessary
d) Resolution of disputes
e) Review & approval of all technical matters
f) Allocation of equipment and material

The following Sub-Clauses 2.7 and 2.8 are added:

2.7 Engineer Not Liable

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

2.8 Replacement of the Engineer

If the Employer intends to replace the Engineer, the Employer shall, not less than 14 days before the

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

5.1 Language(s) and Law

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

5.2 Priority of Contract Documents

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

(1) The Contract Agreement (if completed);
(2) The Letter of Acceptance;
(3) The completed Form of Bid;
(4) Special Stipulations;
(5) The Particular Conditions of Contract;
(6) The General Conditions;
(7) The priced Bill of Quantities;
(8) The completed Appendices to Bid;
(9) The Specifications
(10) The Drawings;

All Drawings and Specifications shall be interpreted in conformity with the Contract and these Conditions. Addendum, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract. If any ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction which shall be binding.

6.1 Custody and supply of Drawings & Documents

The contractor shall supply a soft copy of such drawings in source file and any other format specified by the Engineer.

The following Sub-Clauses 6.6 and 6.7 are added:

6.6 Shop Drawings

The Contractor shall submit to the Engineer for review 3 copies of all shop and erection drawings, if applicable to this Contract as per provision of relevant Sub-Clause of the Contract.

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

6.7 As-Built Drawings

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

10.1 Performance Security

The text is deleted and substituted with the following:

"The Contractor shall provide Performance Security of 10% of the contract Price within Fourteen (14) days after the receipt of Letter of Acceptance. The Contractor shall provide Performance Security in the prescribed Form annexed to these documents in the form of Guarantee from any Schedule Bank in

Pakistan or from a bank located outside Pakistan duly counter guaranteed by a Scheduled bank in Pakistan.

For avoidance of doubt, Bank Guarantee issued by a foreign bank, without counter guarantee from a Schedule Bank in Pakistan shall not be considered as an acceptable Bank Guarantee. The cost of complying with requirements of this Sub-Clause shall be borne by the Contractor."

The following Sub-Clause10.4 is added:

10.4 Performance Security Binding on Variations and Changes

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

11.1 Inspection of Site

Bidder shall inspect the site, examine and obtain all information required and satisfy himself regarding matters and things such as access to site, communication, transport, right of way, the type and number of equipment and facilities required for the satisfactory completion of work, the quantity of various sections of the work, the availability of local labour, availability and rates of materials, local working conditions, uncertainties of weather, obstructions and hindrances that may arise etc., which may affect the work or cost thereof, before submission of his bid. Ignorance of site conditions shall not be accepted by the owner as basis for any claim for compensation. The submission of a bid by the bidder will be construed as evidence that such an examination was made and any later claims/disputes in regard to rates quoted shall not be entertained or considered by the owner.

If any temporary feeder road within site is considered essential for the proper execution of the work this shall have to be formed by the Contractor at his own cost with the prior approval of the Engineer. The Contractor shall organize his own arrangement to transport his equipment, men and materials in such a manner that the completion period will not be exceeded on any account.

The rates quoted by Bidder shall be based on his own knowledge and judgement of the conditions and hazards involved and shall not be based on any representations to the Engineer.

14.1 Programme to be submitted

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receipt of Letter of Acceptance.

The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations.

Each programme shall be in the form of bar chart or a CPM chart identifying the critical activities and include:

a) The order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, delivery to Site, construction, erection and testing.

b) Each of these stages for work by each nominated subcontractor

c) The sequence and timing of site inspections and tests specified in the Contract, and a supporting report which includes:

   i) A general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and

   ii) Details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for

each major stage.

Unless the Engineer, within 21 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Employer's Personnel shall be entitled to rely upon the programme when planning their activities.

If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause.

The period between the Program updates will be 30 days. If the contractor fails to submit an updated program in time, any payment due for his current bills will be withheld till the submission of such programme.

14.3 Cash Flow Estimate to be submitted

The detailed Cash Flow Estimate shall be submitted within 21 days from the date of receipt of Letter of Acceptance

The following Sub-Clause 14.5 is added:

14.5 Monthly Progress Report

During the period of the Contract, the Contractor shall submit to the Engineer not later than the 8th day of the following month, copies of Monthly Progress Reports covering:

(1) A Construction Schedule indicating the monthly progress in percentage;
(2) Description of all work carried out since the last report;
(3) Description of the work planned for the next 56 days sufficiently detailed to enable the Engineer to determine his programme of inspection and testing;
(4) Monthly summary of daily job record;
(5) Photographs to illustrate the status of progress on the Site.
(6) Information about problems and difficulties encountered, if any, and proposals to overcome the same.
(7) Charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, delivery of material to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor.
(8) The details described in Sub-Clause 35.1 [Return of labor & Contractor's Equipment]
(9) Copies of quality assurance documents, test results and certificates of Materials.
(10) List of notices given under Sub-Clause 68.1[Notice to Contractor] and notices given under Sub-Clause 68.2[Notice to Employer & Engineer].
(11) Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations.
(12) Comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

These progress reports will be submitted as per the following distribution list:

(1) GM (PD/GSC) South EHV-II NGC Hyderabad
(2) CE (PD/GSC) South EHV-II NGC Hyderabad
(3) PD EHV-II, Hyderabad
(4) XEN (EHV-II) NGC Hyderabad

During the period of the Contract, the Contractor shall keep a daily record of the work progress, which shall be made available to the Engineer as and when requested. The daily record shall include particulars of weather conditions, number of men working, deliveries of materials, quantity, location and assignment of Contractor's equipment.

14.3 Cash Flow Estimate to be Submitted

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

15.1 Contractor's Superintendence

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

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

The following Sub-Clauses 15.2 is added:

15.2 Language Ability of Contractor's Representative

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

The following Sub-Clauses 16.3 and 16.4 are added:

16.3 Language Ability of Superintending Staff of Contractor

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

16.4 Employment of Local Personnel

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

The following Sub-Clauses 19.3 and 19.4 are added:

19.3 Safety Precautions

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

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

19.4 Lighting Work at Night

In the event of work being carried out at night, the Contractor shall at his own cost, provide and maintain such good and sufficient light as will enable the work to proceed satisfactorily and without danger. The approaches to the Site and the Works where the night-work is being carried out shall be sufficiently lighted. All arrangement adopted for such lighting shall be to the satisfaction of the Engineer's Representative.

20.4 Employer's Risks

Delete the text and substitute with the following: The Employer's risks are:

a) insofar as they directly affect the execution of the Works in Pakistan:
war and hostilities (whether war be declared or not), invasion, act of foreign enemies, rebellion, revolution, insurrection, or military or usurped power, or civil war, ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof, pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds, riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;

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

c) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and

d) any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:
(i) could not have reasonably foreseen, or
(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:
(a) prevent loss or damage to physical property from occurring by taking appropriate measures, or
(b) insure against.

21.1 Insurance of Works and Contractor's Equipment

The minimum insurance amounts and deductibles shall be:

(a) For the Works and Materials: Full value of material.
(b) For loss or damage to Equipment: Full value of the loss/damage.
(c) For loss or damage to property (except the Works, Materials, and Equipment) in connection with Contract: Full value of loss/damage to property
(d) For personal injury or death of the Contractor's employees or other people: In accordance with such applicable laws in Pakistan

21.4 Exclusions

The text is deleted and substituted with the following:
There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20.4 paras (a) (i) to (iv).

25.3 Remedy on Contractor Failure to Insure

Delete the text and substitute with the following:
The Contractor shall effect and keep in force all insurances required under the contract. The Employer shall not affect any kind of insurance on behalf of this project.

25.4 Compliance with Policy Conditions

Delete the text and substitute with the following:

"In the event that the Contractor fails to comply with conditions imposed by the insurance policies affected pursuant to the contract, the Contractor shall indemnify the employer against all losses and claims arising from such failure."

The following Sub-Clause 25.5 is added:

25.5 Insurance Company

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

Costs of such insurances shall be borne by the Contractor.

The following Sub-Clause 31.3 is added:

31.3 Co-operation with other Contractors

During the execution of the Works, the Contractor shall co-operate fully with other contractors working for the Employer at and in the vicinity of the Site and also shall provide adequate precautionary facilities not to make himself a nuisance to local residents and other contractors.
The following Sub-Clauses 34.2 to 34.12 are added:

34.2 Rates of Wages and Conditions of Labour

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

34.3 Employment of Persons in the Service of Others

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

34.4 Housing for Labour

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

34.5 Health and Safety

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

34.6 Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities, for purpose of dealing with and overcoming the same.

34.7 Supply of Water

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

34.8 Alcoholic Liquor or Drugs

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

34.9 Arms and Ammunition

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

34.10 Festivals and Religious Customs

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

34.11 Disorderly Conduct

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

34.12 Compliance by Subcontractors

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

35.1 Returns of Labour and Contractor's Equipment

The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking Over Certificate for the Works.

The following Sub-Clauses 35.2 and 35.3 are added:

35.2 Records of Safety and Health

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

35.3 Reporting of Accidents

The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.
The following Sub-Clause 36.6 is added:

36.6 Use of Pakistani Materials and Services

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

41.1 Commencement of Works

The text is deleted and substituted with the following:

The Contractor shall commence the Works on Site within the period named in Appendix-A to Bid. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

The following Sub-Clause 47.3 is added:

47.3 Bonus for Early Completion of Works

No bonus is admissible for the project.

48.2 Taking Over of Sections or Parts

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

The following Sub-Clause 49.5 is added:

51.2 Instructions for Variations

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

52.1 Valuation of Variations

In the tenth line, after the words “Engineer shall” the following is added:

Within a period not exceeding one-eighth of the completion time subject to a minimum of 56 days from the date of disagreement whichever is later.

53.4 Failure to Comply

This Sub-Clause is deleted in its entirety.

54.5 Conditions of Hire of Contractor’s Equipment

The following paragraph is added:

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

The following Sub-Clauses59.4 & 59.5 are added:

59.4 Payments to Nominated Subcontractors

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

59.5 Certification of Payments & Nominated Subcontractors

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

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

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

60.1 Monthly Statements

In the first line after the word "shall", the following is added:
"on the basis of the joint measurement of work done under Clause 56.1,"

In Para (c) the words "the Appendix to Tender" are deleted and substituted with the words "Sub-Cause 60.11 (a)(6) hereof".
(in case Clause 60.11 is applicable)

60.2 Monthly Payments

In the first line, "28" is substituted by "14".

60.3 Payment of Retention Money

a) The following text is added at the end:
"In addition to above, release of this retention money is subject to issuance of GRN/SRS by In charge of designated NTDC Warehouse for balance material of the project as per material reconciliation report along with certification from In charge of the Ware House of completeness and healthiness of the returned material. The material reconciliation report shall be duly vetted by Chief Engineer (T/L) Design as per as-built profile of the project."

60.10 Time for Payment

No interest is applicable on any delay at the part of the employer. Second Para starting from "In the event of failure" and ending on "under clause 69 otherwise" is deleted.

63.1 Default of Contractor

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

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

65.2 Special Risks

The text is deleted and substituted with the following:

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

67.1 Engineer's Decision

Replace eighty fourth with sixtieth in the eighth line of Para 1 of this clause.

Replace eighty fourth with sixtieth in the third line of Para 3 of this clause.

Replace seventieth with thirtieth in the fourth and fifth line of Para 3 of this clause.

Replace 84 with 60 in the sixth line of Para 3 of this clause.

Replace seventieth with thirtieth in the fourth line of Para 4 of this clause.

67.2 Amicable Settlement

Replace fifty sixth with thirtieth in the fourth line of Para 1 of this clause.

67. 3 Arbitration

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

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

The following paragraph is added:

The place of arbitration shall be Islamabad, Pakistan.

68.1 Notices to Contractor

The following paragraph is added:

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

68.2 Notices to Employer and Engineer

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

a) The Employer: National Grid Company of Pakistan Limited (NGC) [*Formerly NTDC*]

b) The Engineer: **Executive Engineer, TLC Division**, EHV-II, NGC of Pakistan,
B-2, NTPS Colony T.M Khan Road S.I.T.E Area Hyderabad
Telephone No. 92-22-9250133 Mobile No. 0335-7401970
E-mail address: xentlc.ehv2@ntdc.com.pk

69.0 Default of Employer

This clause with all sub clauses is deleted in its entirety.

The following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1and 78.1 are added:

70.1 Increase or Decrease of Cost

Sub-Clause 70.1 is deleted in its entirety.

The following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1 and 78.1 are added:

73.1 Payment of Income Tax

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

73.2 Customs Duty & Taxes

Contractor will submit the invoice inclusive of Provincial Sales Tax. Provincial Sales Tax shall be charged by the contractor and payments will be subject to income tax and sales tax withholding as per Rules mentioned in Federal or Respective Provincial Laws. Copy of sales tax return will be will be provided by the contractor.

74.1 Integrity Pact

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

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

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

75.1 Termination of Contract for Employer's Convenience

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

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

76.1 Liability of Contractor

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

77.1 Joint and Several Liabilities

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

78.1 Details to be Confidential

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

SECTION-VI

SPECIFICATIONS

Section 6 - Specifications (Technical Provisions & Special Provisions)

This Section contains the Specifications, the Drawings, Supplementary Information that describe the Works to be procured, Personnel Requirements and Equipment Requirements.

Table of Contents

Specifications

(Please refer to Annexure-A of this document)

Drawings

(Please refer to Annexure-A of this document)

Supplementary Information Regarding Works To Be Procured

1 ACQUAINTANCE WITH SITE

The Contractor shall be deemed to have inspected and examined the substation Site and its surroundings and information available in connection therewith before submitting his Bid, as to the form and nature thereof, including the subsurface conditions, the hydrological and climatic conditions, the extent and nature of work, goods and materials necessary for the completion of the Work, the means of access to the Site and the accommodation he may require and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Bid.

2 DESCRIPTION OF PROJECT

The Requirement

It is required that civil works, transportation, assembly, erection, testing and commissioning of following works in accordance with the Contract Documents and drawings:

Installation, Erection, Testing & Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II

2.1 POSSESSION OF SITE

Save, in so far as the Contract may prescribe, the extent of portions of the Site of which, the Contractor is to be given possession from time to time and the order in which such portions shall be made available to him and subject to any requirement in the Contract as to the order in which work shall be executed, NGC of Pakistan [Formerly NTDC]shall, give to the Contractor possession of so much of the Site as may be required to enable the Contractor to commence and proceed in accordance with the program referred to in Clause 35 of General Conditions of Contract and otherwise in accordance with such reasonable proposals of the Contractor as he shall, by notice in writing to the Employer, make and will, from time to time as work proceeds, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with due dispatch in accordance- with the said programmer or proposals (as the case may be). If the Contractor suffers delay or incurs expense from failure on the part of Employer to give possession in accordance with the terms of this Clause the Employer shall grant an extension of time for the completion of the Work and certify such sum as, in his opinion, shall be fair to cover the expense incurred which sum shall be paid by NGC of Pakistan [Formerly NTDC].

2.2 LOCATION OF SITES

Site of works is located in Jhamphir, District Thatta. The above site is accessible by road.

3 SITE CONDITIONS

3.1 Site Conditions and Meteorological Data

(1) The Site is subject to dust/thunder and insects and vermin are prevalent. Particular care in design and packing of Goods must therefore, be taken to prevent ingress and effect of wind, dust, insects and vermin and to ensure resistance to attack by insects and vermin.

(2) NGC of Pakistan [Formerly NTDC] does not guarantee the correctness of any data provided herein nor any interpretations, deductions or conclusions relative to subsurface conditions at Site. The Contractor must form his own opinion of the character of the work and of the materials to be excavated. He must make his own interpretations, and satisfy himself by his own investigations and research regarding all conditions affecting the work to be done. The Contractor must assume all responsibility for deductions and conclusions as to the nature or conditions of the materials to be excavated and of doing other work affected by the geology at the Site.

4 MATERIAL AND WORKMANSHIP

4.1 Material and Workmanship

(1) All materials, manufacture, testing and workmanship of material and Work, shall comply with the requirements of the Contract Documents. Material, Work or parts which are not covered by the Specifications given herein, shall comply with the applicable standards, rules, codes and regulations of the Internationally approved standardizing bodies as indicated in these Contract Documents.

(2) The intent of these Specifications is that the materials and workmanship of Work under this Contract should be equal to or superior than those actually described herein. Reference to a brand or manufacture, if made, is only for the sake of comparison as to type, design, character or quality of the Goods or parts and materials described and not be interpreted as eliminating other Goods and materials of equal performance, quality and durability.

(3) In choosing materials and their finishes due regard shall be given to the conditions prevailing at Site.

(4) All matters relating as to the acceptability or otherwise of the Goods, Work and materials offered under this Contract shall be decided by the Employer whose decision shall be final.

4.2 Extent of Specifications

The extent of the Contract Documents is to provide for the Work herein specified to be fully complete in every detail for the function designated. All Goods, materials, fittings, accessories, apparatus, labour or services which are not specifically mentioned in the Contract Documents, but which, in the opinion of the Employer, are usual or necessary for the satisfactory completion of the Work shall be deemed to be included in the Contract Documents and shall be provided by the Contractor without extra cost to NGC of Pakistan [Formerly NTDC].

5 WORK BY CONTRACTOR (SCOPE)

The scope of the work to be executed under this Contract comprises of but not limited to following:

Installation, Erection, Testing & Commissioning of 220/ 132 KV 160 MVA Auto Transformer at 220 kV Grid Station Jhamphir II

Except as otherwise specified or as constrained by the Contractor's standard design, the Works shall generally conform to equipment in layout, control functions and any other feature intrinsic to the orderly and safe operation of the substations as to which requirements the Contractor shall be responsible for satisfying himself. Prior to commencement of Works the Contractor shall visit the Site(s) to be knowledgeable of the detailed requirements.

6 DRAWINGS

6.1 Drawings in Contract

6.1.1 Specification Drawings

The specification drawings show the scope of Work to be performed by the Contractor. These are only reference drawings. Actual drawings shall be shared upon start of work.

6.1.2 Tender Drawings

The drawings provided in the tender shall not be used for execution of the Work unless the Employer gives specific instructions/ approval for such use.

6.1.3 Construction Drawings

The Work shall be performed in accordance with the detailed construction drawings.

The drawings provided with the bidding document are the reference drawings to be used for filling of BOQ only.

The actual construction / work drawings will be issued by the Engineer (Design office, NGC of Pakistan [Formerly NTDC]) to the successful bidder on, "if and when required" basis.

6.1.4 Detail Drawings

All the basic/ scope drawings, specifications, schemes and any other information shall be provided by the Employer to the successful contractor on if and when required basis in due time and in logical order to facilitate proper coordination. However, allied engineering drawings (electrical/mechanical), required for the successful completion of the project shall be responsibility of the contractor, but the contractor will be liable for the Employer's approval before the implementation of such drawings (allied drawings).

6.1.5 **Drawings, Data and Instruction Manuals**

The working drawings shall be provided by Employer "if and when required" basis.

6.2 **Data Other than Drawings**

All of the applicable requirements of this Clause with reference to drawings shall be provided by the Employer and shall apply equally to catalogues, cuts, illustrations, printed specifications, or other data.

6.3 **SUBMISSION AND APPROVALS**

6.3.1 **Work Prior to Provision of Drawings by** NGC of Pakistan [Formerly NTDC]

Any work done prior to the supply of detailed work drawings by the contractor and approval of the same by Engineer/Employer, shall be at the Contractor's risk. The Employer shall have the right to request additional details and to require the Contractor to make any change in the design, which are necessary to conform to the provisions and intent of these Specifications and such changes shall be made without additional cost to NGC of Pakistan [Formerly NTDC]. The supply of drawings by the Employer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. These drawings shall not be held to relieve the Contractor of the obligations to meet all the requirements of these Specifications or of the responsibility for the correctness of the drawings or for correct fit of assembled Goods furnished by the NGC of Pakistan [Formerly NTDC].

6.3.4 **Drawings and Revisions**

All issued drawings and data shall form a part of the Contract. If revisions are made after a drawing has been issued, the revised drawing shall be considered final and become a part of the contract.

6.3.6 OWNERSHIP OF DRAWINGS AND DATA ETC

All the drawings, details, bill of materials and any other information or documents furnished by the Contractor shall become the property of NGC of Pakistan [Formerly NTDC] and shall be non-returnable. NGC of Pakistan [Formerly NTDC] will have the right to use this property.

7 **STANDARDS AND TYPICAL DESIGN**

7.1 **General**

The Specifications cite or imply International Standards and typical design for Work, Goods and materials. Other equivalent Standards and typical designs are equally acceptable provided that they in no way detract from the quality, safety, operability of the Work, Goods and materials furnished. However, when standards or typical design other than those cited or implied are offered by a bidder, he shall set forth in his bid the alternative standards proposed so that a direct comparison can be made before Contract Award. Each specific difference from the Specifications shall be clearly indicated by the bidder. If the bidder sets no alternatives forth, it will be assumed that Work, Goods and material will be in accordance with the International Standards and typical design as cited or implied in the Specifications.

Where the documents provide requirements for material or Goods or Work by specifying a standard such as, for example, one of the international standard organizations, which has its origin in one country, it is not the intention to restrict the requirements solely to that standard and that country. Other standards, including standards of other countries will be accepted provided the requirements thereof in the sole opinion of the Engineer are at least equal to the requirements of the standards specified. The Bidder may propose to the Employer an equivalent standard other than that specified, in which case he shall submit the proposed standard and all other information required by the Employer and shall submit written demonstration that his proposed standard is equivalent to or superior to

the one specified herein. The submission must be made in English language. Moreover the bidder shall also supply copy of the latest revision of the standards used in his design.

7.2 **Applicable Standards and Codes**

(1) All Goods, materials, Work and design shall be generally in accordance with latest revision of the standards specified in the Technical Provisions except where specifically directed otherwise. If these Specifications conflict with any or all the standards stated in the Technical Provisions, these Specifications shall have precedence and shall govern.

(2) In case deviation from the above standards is minor, the approval of the Employer may be given to the use of other national standards prevalent in the country of manufacture. No departure from the standard specified will be considered after the Contract has been awarded unless specific authorization is requested in writing from the Engineer.

8. TRANSPORTATION AND PACKING

8.1 **Packing**

(1) The Contractor shall pack all parts of the Goods / materials for transportation in accordance with the requirements of the Contract Documents and in the best possible manner to withstand damage or loss from repeated handling and extremes of climate during transport and storage at Site. All parts of the Goods and materials shall be packed so as to guarantee safe transportation of the Goods and materials from site to the NGC of Pakistan [Formerly NTDC] designated stores under any conditions and limitations that may be encountered. The manner of packing shall be such that it protects the Goods, and other material against breakages, damages and losses from the factory until its arrival at its final destination at the Site.

(2) The final packing shall be such that the weight and dimensions of packages are within reasonable limits in order to facilitate handling, storage and transportation.

8.2 **Lifting**

The method of lifting, type of equipment and type of slings, used for handling the conductor reels are subject to approval by the Engineer. The wooden reels are so constructed as to be supported either on an axle through the arbor hole or by the reel flange. When an axle supported from above lifts the reels, a spreader bar must be employed to prevent reel damage by inward pressure on reel flange. In no case shall metallic slings or other metallic equipment shall come in contact with conductor or overhead shield wire or ground wire.

8.3 **Slings**

If the use of slings is necessary, these shall be of a flexible type and preferably manila rope or other non- metallic materials. The use of steel wire, mesh or chain link slings is prohibited unless they are covered with rubber hose or some similar material.

8.4 **Cost of Transportation**

(1) The contractor shall be responsible (bear the cost) for the transportation of goods/plant/equipment from site to NGC of Pakistan [Formerly NTDC] warehouses as included in BOQ.

(2) The Contractor shall insure and transport the Goods, materials and his Equipment from site to nominated warehouse and shall be solely responsible for selection of routes and carriers, and expediting in order that all shipments are safely and expeditiously transported to the Warehouse.

(3) The Contractor shall be solely responsible for satisfying himself at the time of transportation as to the adequacy of the road surfaces and structures. All costs related with reinforcement of roads, structures, diversions and the like, if any, should be borne by the Contractor. The Contractor shall advise the concerned authorities in advance of the proposed transit of the heaviest and largest items of Goods and Equipment and shall comply with instructions given by said authorities.

(4) Within the limits imposed by law, the Contractor shall be entitled to utilize all the roads and other communication facilities existing in the country, to the same extent as any other user.

8.5 **Unloading and Storage at the Warehouse**

(1) The Contractor shall unload all Goods and other material (except Spare Parts) at the Warehouse. Items for permanent installations shall be properly stored and shall be protected as required to prevent damage or deterioration of any type. Storage/ Stacking methods shall be such as to cause minimum inconvenience to others and shall be arranged to facilitate inspection.

(2) All Goods and other material storage shall comply with the requirements of the Specifications or to the approval of the Engineer.

(3) The Contractor shall be held responsible for all costs of damage to the steel structures (including replacement) after they are dismantled from site.

(4) Lifting of pieces, which are galvanized or painted, shall be by hand or by hemp rope on as approved by the Engineer, or by wire rope which is suitable covered with rubber or similar material lifting by steel chains is prohibited. Steel pieces shall not be dropped, thrown, or skidded over steel, concrete or rock surfaces.

(5) When steel components are stored temporarily they shall be blocked on wood & separated to prevent damage.

8.6 **Ownership of Packing Materials**

All packing boxes, reels, shipping containers except those containers, which are not the property of the Contractor, planking covers, etc, shall become the property of NGC of Pakistan [Formerly NTDC]. All the packing materials shall be handed over to NGC of Pakistan [Formerly NTDC] immediately after storage requirements of the Goods or part thereof and other materials are over.

8.7 **Receiving Reports and/ or Damage Reports**

(1) The Contractor shall prepare and submit receiving reports to NGC of Pakistan [Formerly NTDC] and the Employer to cover shipments received and checked at the job Site and/or storage area. Shipment on arrival at the job Site and/or storage area shall be unloaded, opened, and carefully checked by the Contractor in the presence of a designated representative of the Engineer / NGC of Pakistan [Formerly NTDC] for any loss and damages in transit. In the event of loss and/or damage, the Contractor shall immediately report to NGC of Pakistan [Formerly NTDC]/Engineer. Prompt action shall be taken by the Contractor with intimation to Engineer/ NGC of Pakistan [Formerly NTDC], to record and remedy the damaged or missing item(s) and it shall be ensured that the deliveries meet the final delivery dates and/or commissioning dates.

(2) In all cases of irreparable damage, the Contractor shall immediately notify the Original manufacturer (s) for re-manufacture and supply of the damaged part(s).

All scope of the works shall be performed in accordance with the WAPDA/NTDC relevant

09 **SHOP INSPECTION AND ORDERS FOR MATERIALS (NOT APPLICABLE)**

11 **SCHEDULE, PROGRESS REPORTS AND MEETINGS**

11.1 **Schedule**

The Contractor shall carry out the Work in accordance with the dates/ periods specified in Schedule provided by the contractor and approved by the Employer, which shall be provided. The Contractor shall regularly review the Schedule and notify the Employer promptly of any revisions, which in his view may be required from time to time.

11.2 **Form of Schedule**

The Schedule shall be a detailed CPM (critical path method) type, time scaled according to calendar dates and Project month numbers. The CPM for planning, scheduling, and controlling will be used for the Contract. The

Contractor shall submit a schedule showing the logical sequence in which the Work will be carried out in sufficient detail to satisfy the Employer that the Work is thoroughly planned and meets all the requirements of the Contract Documents. In preparing the Schedule, the Contractor shall fully take into account the requirements (and possibilities) for inland transportation.

11.3 **Erection/Construction**

(1) The delivery of components and parts of the Goods/ Material should be so estimated so as to permit erection work and construction work to proceed in an orderly manner so that the required Commissioning Dates can complete the Work. The Contractor in preparing and regularly reviewing the Schedule in respect of the erection work shall comply with the requirements of Contract.

(2) The Contractor shall promptly bring to the attention of the Employer any amendment to the Schedule, which in his view may at any time be required to ensure that the Commissioning Date/ Periods will be met.

(3) Prior to steel erection, the Contractor shall examine the existing work on which this work is in any way dependent (that is , verify elevations & dimensions of foundations including anchor bolts & embedded angles) & report to the Site Engineer any errors on discrepancies that may affect the Contractor's work.

(4) Should the Contractor encounter any foundation surfaces or anchor bolts & embedded parts, which do not match the structural steel he shall immediately notify the Site Engineer. If in the opinion of the Site Engineer the discrepancy is due to misplacement of the concrete, anchor bolts or embedded parts the Contractor will be required to rectify the defect, all at his own expense & to the satisfaction of the Engineer. If in the opinion of the Engineer, the discrepancy is due to faulty fabrication of the structural steel, then the rectification of the defect shall be the responsibility of the Manufacturer(s) of the Plant.

(5) Unless otherwise specified, the Contractor shall assemble & erect the switchyard structures to the tolerance dictated by ASTM or equivalent DIN Standards.

(6) The erection tolerance on a post insulator support structure & a lightning arrestor support structure shall be such that a plumb line passing through the centre of the bolt circle on the top plate of the structure shall pass within +/- 6 mm of the location lines shown on the drawings. The anchor bolts in the structural foundation shall be located to within +/- 6 mm of the location lines shown on the drawings.

(7) The top plate of the Post Insulator support structures shall be aligned so that the center line of the plate shall be parallel to the longitudinal axis of the bus it is supporting, to a tolerance of 3 mm over the length of the plate.

(8) The top plate of the bus support structure shall be level within 3 mm

(9) All other structures shall be erected-plumb or level within plus or minus a tolerance or 1 in 1000 & according to ASTM OR EQUIVALENT DIN Standards.

(10) The structural steel shall be assembled and erected in such a manner as to ensure that members are not subjected to any damage or undue stress.

(11) Sections or portions of the structure shall be assembled and bolted on the ground so that they can readily be lifted in consecutive manner & connected together in the air to form a complete structure. Care shall be taken to prevent damage to the steel pieces or galvanizing thereof. The tools & method of assemble shall be subject to the approval of the Engineer but generally only flat non-adjustable or socket type wrenches shall be used.

(12) During assemble & erection, reaming or holes is prohibited unless the Engineer gives his approval, which shall be based solely on deviations in the fabrication of the steel. The non alignment of holes in connecting members if due to faulty erection procedures shall be corrected by the Contractor at his own expense.

(13) Driving of pins through the bolt holes for the purpose of enlarging the holes is prohibited.

(14) Structures shall be erected in accordance with the erection drawings, plumb and true in all respects. Bolts shall be of the length specified & shall ensure that members rest on the shank of bolt.

(15) The legs & principal bracings of all panels of the structure shall be erected & bolted at a lower elevation before proceeding to a higher level.

(16) Members of each panel shall be installed as erection procedure. The Engineer must approve any deviation from this procedure in writing.

(17) Punching: when instructed by the Site Engineer, bolt threads shall be punched with steel point or chisel at the surface of the tightened nut. Where lock nuts or lock washers are provided punching will not be required but the nuts shall be properly tightened.

(18) Step Bolts: These shall be installed in each tower as it is erected.

(19) Drifting / Filling: Holes shall not be enlarged by drifting / Filling

(20) Installation of Bolts: Head of bolts shall be installed at the out side face of the structure whenever possible. Lock washers shall be used with all bolts. Bolts shall not be tightened with adjustable wrenches.

(21) Nuts & bolts shall be tightened to an amount corresponding to the full effort of a man using a 300 mm ratchet wrench, or & instructed by Site Engineer.

11.4 Progress Reports

(1) The Contractor within 07 days from the date of the Letter of Acceptance shall submit in writing for the approval of Employer a Schedule for the erection, testing and commissioning of the Goods/Material and construction of the associated civil work.

(2) The submission to or approval by the Engineer/ NGC of Pakistan [Formerly NTDC] of such Schedule etc. shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

(3) At monthly intervals after submission of the Schedule, the Contractor shall submit to the Employer up to five (5) copies of a written detailed progress report in an approved form together with copies of the above mentioned Schedule indicating the stage reached in design, approval of drawings, ordering and procurement of materials, erection/construction, in percentage terms. Such monthly reports shall show the actual progress plotted against the scheduled progress. These reports shall be accompanied by such photographs, diagrams, bar charts, and curves in approved standard form, as may be required by the Engineer. The reports shall be forwarded not later than the 8th of the subsequent month. The numbers of copies shall be as stipulated in the Specifications or as instructed by the Engineer.

(4) The Employer shall at all reasonable times be afforded access to the Contractor and any Sub-Contractor's premises for the purpose of ascertaining progress.

11.5 Meetings

(1) Soon after the date of signing of Contract, the Employer will, with the approval of NGC of Pakistan [Formerly NTDC] require a conference with NGC of Pakistan [Formerly NTDC] and the Contractor at a place mutually agreed upon, to discuss scheduling of drawings, and other similar problems, which may be pertinent to the completion of the Project.

(2) At monthly intervals or from time to time during the execution of the Contract, the Employer may call meetings, either in his Offices or at the Contractor's Offices in Pakistan or NGC of Pakistan [Formerly NTDC] office as is deemed necessary for the purpose of progress monitoring and proper execution of the Contract.

(3) As required by the Engineer, responsible representatives of the Contractor shall attend such meetings.

(4) All expenses incurred by the Contractor for attending such meetings shall be borne by the Contractor and shall not be reimbursable.

12. SITE FACILITIES AND SERVICES

Attention is drawn to the obligations of the Contractor to make his own arrangements at his own expense for Services or facilities provided to his employees. Any cost incurred by the Contractor in respect of any of such Site

facilities or services under the Contract shall be deemed to be included in the rates and prices in the Price Schedule and no separate payment, therefore, will be made to the Contractor.

12.1 **Accommodation**

(1) The Contractor shall provide and maintain at his cost residential accommodation and transportation facilities for his own use.

(2) The Contractor shall provide and maintain such housing accommodation and amenities as he may consider necessary for all of his supervisory staff and labor employed for the purposes of or in connection with this Contract including all fencing, electricity, supply, sanitation, cook houses, fire prevention, water supply and other requirements in connection with such housing accommodation or amenities.

12.2 **Site Offices**

(1) The Contractor shall carry out investigation, design and construction of theSite office required for execution of the work and submit such design in writing to the Employer and obtain his approval.

(5) The location of the site office will also be submitted to the Employer for approval prior to the construction of the same.

(6) The Contractor shall, at his expense, carry out maintenance and management of the above office.

(7) After completion of the work, the Contractor shall dismantle or leave the above office intact subject to the approval of the Engineer.

12.3 **Work yards and Storage Areas**

(1) No storage site shall be provided by NGC of Pakistan [Formerly NTDC] to store Goods, materials or equipment. The Contractor shall procure, furnish, provide and arrange for all the necessary services and be responsible for the construction and maintenance of the necessary construction campus, offices and warehouses; and perform all other work necessary for completion of the Work described herein in strict conformance with these Specifications.

(2) The Contractor shall provide his own watchman service to ensure security and safety of the Goods, materials and Work prior to NGC of Pakistan [Formerly NTDC]taking over the Work.

12.4 **Temporary Buildings**

(1) The Contractor shall provide and maintain all temporary structures required including warehouses, changes, change houses for workmen, sheds, etc. He shall also provide his own field office complete with telephone so that he or his official representative can be contacted by NGC of Pakistan [Formerly NTDC] and/or Employer at all times.

(2) Such temporary buildings and/or utilities shall remain the property of the Contractor and shall be removed by him at his expense upon the completion of the Work and the Site reinstated to its original condition, all to the approval of the Engineer.

13 **MEASUREMENTS AND PAYMENTS**

The measurement for payment and payment for the various price schedule items will be as follows:

13.1 Ninety (90%) percent of the Contract Price against Monthly Progress Payment, certified by the site Engineer, of Work completed. Retainage from monthly progress payments will be deducted until an amount equal to ten percent (10%) of the Contract Price is reached. Thereafter no further deductions will be made.

13.2 The retained five (5%) of the Contract Price upon completion of all the Work required by this Contract Document & acceptance in writing by NGC of Pakistan [Formerly NTDC]. Final payment cannot be made until the Contractor clears & finalizes all accounts of plant furnished by NGC of Pakistan [Formerly NTDC] & equipment furnished by NGC of Pakistan [Formerly NTDC].

13.3 The Site Employer will release the balance 5% to the Contractor after “Defect Liability Period” on verification.

14 EXPEDITING

The Contractor shall provide the Employer with un-priced copies of the Contractor's Purchase Orders for material or approved Subcontracted Work at the time any such orders are placed. The Contractor shall also provide the Employer with any other relevant information requested to ensure proper expediting and scheduling of the Work.

15 PAYMENT FOR WORK REQUIRED BY SPECIAL PROVISIONS

Unless expressly excluded, the cost of all work required by the "Special Provisions" shall be considered to be included in the price and amounts quoted in the "Price Schedule".

16 COMMUNICATIONS TO THE ENGINEER

Pursuant to the definition of Engineer, the Employer has established a Project Office at Islamabad to which the Contractor shall address all communications for the approval etc., as follows:

Executive Engineer (EHV-II) NGC of Pakistan [Formerly NTDC]
B-2, NTPS Colony T.M Khan Road S.I.T.E Area Hyderabad
Telephone No. 92-22-9250133 Mobile No. 0335-7401970
E-mail address: xentlc.ehv2@ntdc.com.pk

Or

An Engineer (individual or firm) designated by the Employer.

The Employer will establish a Site Office to supervise the Site activities. The address of the Engineer's Office at Site shall be communicated to the Contractor at that stage.

17. SPECIFICATIONS - TECHNICAL PROVISIONS

DRAFT

SPECIFICATION P-

CIVIL WORKS

NATIONAL TRANSMISSION AND DISPATCH COMPANY DESIGN DEPARTMENT (NTDC)

CIVIL WORKS

1. INTRODUCTION

5.1 General

This section comprises the Standards and Specifications pertaining to the fundamental requirements of design, material, workmanship, construction, testing, inspection and maintenance of the Civil Works required or specified under the Contract. The Contractor shall perform the work in accordance with these specifications and other specifications supplemental to these specifications as may be specified by the Engineer from time to time. Should the Contractor follow other specifications, the Engineer prior to carrying out these works must approve these.

1..1 Scope

The civil engineering work to be done under this contract shall consist of design, construction, testing, supply, delivery, supervision, installation, commissioning and guaranteeing of all works shown on the drawings and specified and implied herein.
The material and workmanship shall be the best of their respective kinds and to a standard not less than specified herein.

1..2 Works

The Contractor shall carry out all the works required for the design, construction, completion and maintenance of the Civil Works required under the Contract including foundations, cable trenches, pavements, roads, buildings, drainage and other allied works as required or specified in the Contract and as shown in the drawings.

The prices of all additional works, which are not shown in “Price Schedule” but specified in the Contract Documents, shall be included in the prices of other items of “Prices Schedule”. The Contractor shall not claim additional cost for any item, which is required to be executed as per Contract Documents but not specially mentioned in the “Price Schedule”.

1..3 Extent of Work

Reference should be made to the tender layouts and other tender drawings in Volume (VOL-II).

The details shown on the drawings shall be used for the purpose of tendering. The Contractor shall note that he is responsible for submitting all designs and drawings for all elements of the works as required and specified, in accordance with the actual soil conditions and design data that prevail at each Substation site and as instructed by the Engineer.

The Contractor is bound to provide complete works, even if the constructions, equipment or services to be provided are not specifically mentioned in the specification.

The Contractor shall be responsible for, but not be limited by, the following for all substation civil works:

- Site surveys and soil investigations
- Testing of soils, water and materials used
- Earthworks, grading and landscaping
- Temporary and permanent access roads to the substation from public roads
- Substation buildings to accommodate the 220 kV and the 132 kV switchgear
- New Control Building for and associated control and protection equipment
- 220/132 kV Transformer foundations, bunds, oil containment and fire walls
- Mechanical Workshop, Metering and Guard House buildings
- Cable trenches and ducts
- Boundary wall and main and personnel gates
- Structure and plant foundations
- Transformer roads, walkways and parking lot and surface chippings
- Foul and surface water drainagesystems, septic tank and disposal arrangements.

- Heating, Ventilation and Air Conditioning
- Building Services - plumbing, water, small power and lighting, telephones, fire detection, etc
- Intruder alarms
- Water tanks
- Fire hydrants/fire fighting equipment's
- Temporary works
- Design, preparation of detailed construction drawings and bending schedules,
- completion and maintenance of works,
- Preparation of As-built documentation.

1..4 **Materials:**

i) The Contractor shall furnish all materials and equipment's for the performance of civil work.

ii) Materials to be used for civil work shall conform to the relevant ASTM standards and specifications. However in case of using other standards, the Contractor shall obtain prior approval of the Engineer.

iii) In all matters relating to the acceptance or otherwise of the equipment and offered under this contract the decision of the Engineer shall be final.

The Engineer shall have the right to reject any material and/or equipment, which do not meet the requirements of the Contract Documents. All rejected material or equipment shall be removed from the Site as soon as possible.

The Engineer reserves the right to witness any test on material if necessary. The Contractor shall provide proper facilities to witness tests and shall also bear all the expenses on this account. Should the Engineer require the detailed data on material, the Contractor shall furnish the same in writing to the Engineer.

2. DESIGN CONDITIONS

5.1 General

All drawings and statements shall be in the English language and metric system of measurements shall be used.

The following design conditions shall be used for the design of civil work and shall not be deviated unless approved by Engineer.

5.1 Design Condition

The values used in this project are as follows:

i) **Seismic Coefficient**:

Vertical Kv = As per UBC / Pakistan Building Code

Horizontal Kh = As per UBC / Pakistan Building Code

ii) **Wind Load**:

Wind pressure $Fw = Cxq$
Where $q = 1/2xpV^2$

p = Air density/acc. (0.125 kg $sec^2/m4$)

V = Wind velocity (45m/sec)

c = Shape factor
(for circular equipment 0.8 (for Angular equipment 1.2)

2.3 **Design of Foundations:**

1) Geotechnical Investigations

The Contractor shall carry out the Geotechnical investigations at Site just after award of the Contract under the supervision of the Engineer to design the foundations. For this purpose the Contractor shall submit his proposal regarding the type of tests and their locations at Site for review/approval of the Engineer. After performing Geotechnical investigations, the Contractor shall submit Geotechnical investigation report and his recommendations for design of civil works for review/approval of the Engineer.

2) Foundations

All foundations shall be designed upto 200 mm or as shown in the drawings from top of gravel level, appropriate slope shall be provided on the top end of the foundation in order to ensure sufficient drainage. The load for design of foundation shall be taken from the foundation reactions calculated in the design of gantries and respective equipments after applying appropriate load factors.

The Contractor shall submit to the Engineer for his approval calculations and load analysis used for design of gantries, equipment foundations and building works.

The size and type of foundations i.e. spread footing, mat footing or pile foundations including soil replacement if any shall be based on Geotechnical Investigation Report.

The gantry stubs and anchor bolts shall be available at Site before pouring of concrete for gantry and equipment foundations. If block outs are to be provided in the foundations due to any constraint, pre-mixed non-shrink grout shall be used for the embedment of stubs and anchor bolts as per approval of the Engineer.

3) Leveling Concrete

A leveling concrete shall be placed in thickness of 100mm or as shown in drawings.

2.4 **Design Standard and Code**

For foundations and building designs, the Contractor shall conform to the applicable requirements of the latest revisions of following standards and publications, in principle.

1) ASTM (American Society for Testing and Material)

2) ACI(American Concrete Institute)

3) BS (British Standards) – where specified only

2.5 **Testing**

In addition to following tests on coarse and fine aggregate to be used for constructions;

i) Specific gravity of aggregates

- Coarse grading
- Fine grading

ii) Unit weight

iii) Gradation analysis

iv) Flakiness and elongation indices

v) Log Angle Abrasion:

- Coarse grading
- Fine grading

vi) Soundness

vii) Crushing

viii) Water absorption

ix) Aggregate impact value

x) ASR test for aggregates

xi) Petrographic test:

- Fine aggregates
- Coarse aggregates

The following chemical analysis shall be carried out for water to be used in concrete, ground water and for soils which are to come in contact with concrete:

- pH
- Chloride mg/litre
- Magnesium, mg/litre
- Ammonium, mg/litre
- Sulphate. mg/litre
- Potassium permanganate, mg/litre
- Total hardness milli equivalent/litre
- Non carbonates
- Carbonic acid

Cement to be used shall have an alkali content less than 0.5% of soda equivalent. Test reports for the tests carried out to verify the alkali contents shall be submitted to the Engineer for review and approvals.

The Contractor shall compare chemicals found in water, soil and construction material with those values allowable in design code and submit report for Engineer's approval. The Contractor shall take precautions in designing civil works and shall add admixture in concrete and take remedial measures to prevent structure from any expected attack from chemicals observed.

3. TEMPORARY WORK

5.1 General

1) This clause covers the furnishing of all appliances, labour, materials tools, transportation and services required to perform and complete all preliminary work and temporary construction.

2) Immediately after award of the Contract, the Contractor shall submit to the Engineer in writing the schedules for machinery and equipment to be supplied and temporary work to be constructed by the Contractor in connection with the execution of the permanent work.

Even though such schedules have been submitted to the Engineer, by no means the Contractor shall be relieved from any liabilities and responsibility to be borne by him in accordance with the Contract.

However, the schedules for minor and simple work may not be submitted if allowed by the Engineer.

4) Any drawing and design calculation sheets for the equipment to be used and for the temporary work specified in the specifications shall be submitted to the Engineer for his approval.

5.1 **Scaffoldings and Path**

In order to complete the construction, the Contractor shall furnish and maintain all required scaffolding, stairways, platforms and other necessary pertinents.

5.1 **Temporary Transportation Road**

1) The Contractor shall carry out investigation, design and construction of the temporary transportation road required for execution of the work at his expense, and submit such design in writing to the Engineer and obtain his approval.

2) The Contractor shall, at his expense, carry out maintenance and management of the temporary transportation road.

3) After completion of the work, the Contractor shall dismantle or leave the temporary transportation road as mutually agreed by the concerned parties subject to the approval of the Engineer.

5.1 **Site office**

1) The Contractor shall carry out investigation, design and construction of the Site office required for execution of the work including fully furnished office for Project Director and his staff at his expense, and submit such design in writing to the Engineer and obtain his approval.
2) The location of the site office will also be submitted to the Engineer for approval prior to the construction of the same.
3) The Contractor shall, at his expense, carry out maintenance and management of the above office.
4) After completion of the work, the Contractor shall dismantle or leave the above office intact subject to the approval of the Engineer.

4. **EARTH WORK**

5.1 **General**

This clause covers the performance of all works in connection with the required cutting, filling, leveling and compaction of site area, excavation for the various type of foundations as shown in the drawings, or any other excavation and banking that may be necessary during the progress of works including the removal, use or disposal of all excavated material.

5.1 **Clearing and Grubbing**

1) Clearing and grubbing shall include dismantling and removal of structures, removal of trees and shrubs, stumps and other obstacles from the area necessary for the execution of work. The Contractor shall cut and remove all such objects from the project area upto any lead as approved by the Engineer.

2) The Contractor shall not cut any tree outside the premises of the construction site without permission of the parties concerned.

3) Clearing and Grubbing shall also include removal of unwanted top layer upto 150 mm, if required.

5.1 **Excavation**

1) Excavation under this section shall consist of the removal, hauling dumping, and satisfactory disposal of all materials from required excavations for leveling the site area and construction of civil works. Excavation in rock by means of drilling, blasting, chemicals etc. shall also be done by the contractor wherever required.

2) The excavated slope surface shall be protected against any erosion due to heavy rains during construction period. Should any damage be caused on any face of slope, the Contractor shall immediately repair any such damage at his expense.

3) Excavation shall be carried out by adopting a suitable method for excavation of the ground so as not to loosen the ground outside the excavation. If necessary, temporary sheeting shall be constructed.

4) During excavation, work shall be performed carefully so as not to cause any damage to adjacent structures and buried structures owned by the public or third party. The execution of work in such areas shall be carried out following instructions of the Engineer

5) If the excavated material is to be temporarily stockpiled, designated spaces shall be kept at suitable distance from the shoulder of the road while considering the earth pressure at the excavated surface and the working space. Temporary sheeting or other such structures, if necessary, shall be constructed so that the stockpile can be protected from damage or being washed away

6) After completion of excavation, excavated widths and bottoms shall be subject to inspection by the Engineer.

7) Any and all excess excavation for the convenience of the Contractor or over excavation performed by the Contractor for any purpose or reason, except as may be ordered in writing by the Engineer, and whether or not due to fault of the Contractor, shall be at the expense of the Contractor. All such excess excavation shall be filled at the expense of the Contractor with materials as approved by the Engineer. However, for the switchyard equipment, gantry and building foundations, excess excavation underneath the foundations if any done, shall be filled with lean concrete at the expense of the Contractor.

8) The Contractor may request the Engineer in writing to change the excavation line as required according to the soil conditions of the foundation during the progress of excavation line, the Contractor shall prepare the revised design of the said foundation and submit it to the Engineer for his approval.

9) The Contractor will carry out dewatering of structural and equipment foundations if required to maintain excavations free of water as required for proper construction of the works. Dewatering shall be accomplished in a manner that will prevent the loss if fines from the foundations, will maintain stability of excavated slopes, will result in all construction operations being performed free form standing water, and will result in all foundations being sufficiently dry for proper bonding of the backfill material with the foundations and proper compaction of the material placed.

10) If at any point, in any excavation, material unsuitable for foundation is encountered, as determined by the Engineer, the engineer shall order, in writing, removal of all such materials and refilling with selected materials thoroughly compacted by tamping or rolling in layer not more than 150mm thick

5.1 **Excavation**

1) Filling and back-filling shall be executed as construction proceeds alongwith the removal of shoring and other materials at the filling and back-filling site.

When sheeting is to be let and buried in order to prevent shear failure of soil or due to some other inevitable reasons, it shall be done according to the direction of the Engineer.

2) Except as noted otherwise in the specifications or the drawings, all the materials for filling and back-filling shall comply with the following requirements.

a. Material shall not include any harmful materials, such as fertile soil or pieces of wood, slurry mud organic and other unsuitable material.

b. Material shall not be of an extreme swelling nature.

c. The gradation of the general fill material (except the fill material to be used to raise the switchyard area which shall be approved by the Engineer separately) shall conform to the following limits:

Material Size, U.S. Shieve Series		Percent Finer Than, by Weight
No.	10	100
No.	50	70-95
No.	100	25-75
No.	200	0-15

However, for the engineered fill under the light structures i.e. foundations, proposal of well graded gravelly sand shall be submitted by the Contractor for approval of the Engineer.

d. No stones or the like shall be used for filling and back-filling.

e. After the foundation structural works within excavations have been inspected and approved, the excavations hall be refilled with selected material taken from excavation, if so authorized by the Engineer. Impermeable clay shall not be used for back-filling of a structure which is susceptible to earth pressure. Material shall be placed with care around pipes to avoid damage.

Location of borrow pits and method of obtaining materials for banking shall be reported to the engineer in advance for the approval.

3) If the inflow of water exists at the site of filing and back-filling, it shall be appropriately handled at the expense of the Contractor.

4) The compaction shall be made in the filed by ramping machines or other mechanical means as approved by the Engineer. The layer of compacted earth filling shall not be more than 15 cm per lift, and it shall be graded at horizontally as possible, and shall be sufficiently compacted to produce not less than 95% o laboratory maximum dry density as determined by ASTM Designation D1557-00 “Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort”. Field dry density shall be measured according to ASTM D-1556-00 – Standard Test Method for Density and Unit Weight of Soil in Place for Sand – Cone Method or ASTM D-2937-00 “Standard Test Method for Density of Soil in Place by the Drive – Cylinder Method” or other methods as approved by the Engineer.

5) If there is any surface or buried structure owned by the public or the third party at the site of filling and back-filling, care shall be taken so as to cause no harmful effect to them and the execution of the work shall be carried out following instructions by the Engineer.

6) For back-filling adjacent to a structure, compaction and back-filling shall be carried out in such a manner that will prevent damage to the structure.

5.1 **Disposal of Excavated Materials**

1) Spoils produced by excavation shall be piled, graded, sloped or disposed of at the locations as directed by the Engineer.

2) In transporting the spoils, care shall be taken so as to neither hamper traffic nor cause trouble to the third party by scattering the spoil over the road.

5.1 **Inspection:**

The instructions and tests specified herein shall include the following:

1) Volume of work executed

2) Inspection of test of construction materials

3) Inspection of excavation (including bed surface)

4) Inspection of disposal of excavated materials

5) Inspection of compaction test of back-filling

6) Other tests and inspections which the Engineer deems necessary

7) Other tests and inspections required according to pertinent regulations, codes and standards

The works for which the Engineer deeds inspection necessary, shall be executed in the present of the Engineer.

5. REINFORCED CONCRETE WORK

5.1 General

1) This clause covers the performance of all reinforced concrete work for permanent structures in accordance with the drawings and these specifications.

2) The Contractor shall furnish all materials and equipment for the performance of concrete work.

3) Reinforced concrete work and plain concrete work shall comply with all requirements of ACI 318-02 (latest revision). Also test on material shall, in principle, follow relevant ASTM Standard or equivalent approved by the Engineer.

4) Concrete shall have the uniform quality with the required strength, durability water lightness etc.

5) Strength:

a) The strength of concrete shall generally be based on 28 days compressive cylinder strength

b) Compression tests for concrete shall be performed in accordance with relevant ASTM standards or approved equivalent.

o28 = 350 kg/cm²	For grouting under base plate of equipment steel structure with mixing of non-shrinking agent.
o28 = 280 kg/cm²	For water retaining structures.
o28 = 211 kg/cm²	For foundation of each equipment gantry towers, cable trenches, buildings and other structures as specified. The minimum cement contents shall be 350 kg per cubic meter of concrete.
o28 = 71 kg/cm²	For leveling concrete.

Where o28 means concrete compressive cylinder strength at the age of 28 days.

Table-1 – Basic Mix Data

Design Strength o28 kg/cm²	Max Size of Aggregate (mm)	Slump (cm)	Air (%)	E/ment	Description
350	As per Table-3	4 ± 2	-		Grouting under base plates equipment steel structure.
280	As per Table-3	10 ± 2	4 ± 1		Water retaining structures.
210	As per Table-3	6 ± 2	4 ± 1		Foundation, buildings and other structures.
140	As per Table-3	10 ± 2	4 ± 1		Leveling concrete.

Note: 1. Specific gravity in design
Cement – 3.15, Fine Aggregate – 2.62, Coarse Aggregate and Crushed Stones – 2.62.

2. The Contractor shall submit proposal of mix design for approval of the Engineer.

3. Maximum size of coarse aggregate may be reduced for columns, beams and slabs etc. as directed by the Engineer.

5.2 Material

1) Material for Reinforced Concrete

a) Cement

Classification shall be Ordinary Portland Cement to be complied with British Standard 12:1971 "Specifications for Ordinary and Rapid Hardening Portland Cement" or to ASTM Designation C150-99a Standard Specification for Portland Cement for Type-I", or equivalent and Sulphate Resistant (SR) cement shall be used in water logged area and as per requirements of Geotechnical investigations and this shall be according to ASTM C150-99a Type-V.

b) Water

i) Water shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances deleterious to concrete or reinforcement.

ii) Sea, river or canal water shall not be used in mixing concrete for reinforced or plain concrete.

iii) Test as described in clause 2.5 shall be within acceptable limits.

iv) Non-potable water shall not be used in concrete unless specifically approved by the Engineer.

c) Fine Aggregate

i) **General**

Fine aggregate shall be clean, strong, hard, durable, suitably graded and free from injurious amounts of dust, mud, organic impurities, salts etc.

Beach sand shall not be used for concrete.

ii) **Grading**

Fine aggregate shall consists of large and small particles suitably mixed, and its grading shall, as a standard, be within the range shown in Table-2.

Table - 2 - Standard Grading of Fine Aggregate

Sieve Designation U.S. Standard Square Mesh	Percent Passing
0.375 in (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	80 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (600 mm)	25 to 60
No. 50 (300 mm)	10 to 30
No. 100 (150 mm)	02 to 10

The sand equivalent value of the fine aggregate, as determined by ASTM Designation D-2419-02 "Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate", shall not be less than 75. The Fitness Modules shall range between 2.3 to 3.1.

d) **Coarse Aggregate**

i) **General**

Coarse aggregate shall be clear, strong, hard, durable, suitable graded and free from injurious amount of flakes, elongated pieces, organic impurities, salts etc.

ii) **Crushed Stones**

Coarse aggregate shall consist of large and small particles suitably mixed and its grading shall be within the range shown in Table-3 as a standard.

Sieve analysis shall be performed in accordance with ASTM Designation C33-02a, or equivalent.

Table - 2a - Standard Grading of Coarse Aggregate

	Percent by weight finer than each laboratory sieve		
US Standard Sieve Size	1.5 in. to 0.75 in.	0.75 in. to No. 4	0.5 in. to No. 4
2 in.	100	-	-
1.5 in.	90 to 100	-	-
1 in.	20 to 55	100	-
0.75 in.	0 to 15	90 to 100	100
0.5 in.	-	-	90 to 100
0.375 in.	0 to 10	20 to 55	40 to 70
No. 4	-	0 to 10	0 to 15
No. 8	-	0 to 5	0 to 5

e) **Reinforcement**

Steel bar reinforcement, shall be deformed bars conforming to the provisions of ASTM Designation A615/A615M-01b, "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement" and shall have a minimum yield stress of 40,000 psi. Steel bar reinforcement in the openings to be filled with second stage concrete shall be of mild steel. At least 45 days prior to issuing each order for reinforcing steel, the Contractor shall notify the Engineer in writing of the Contractor's proposed sources of supply so that the Engineer may make arrangements for plant examination, testing and inspection. A similar notification shall be given prior to each shipment to the Site. The Contractor shall provide such assistance, instruments, machines, labour and materials as are required for examining, measuring and testing the quality, weight or quantity of steel at the mill and at the Site. If and when required Contractor shall provide all necessary facilities to Engineer for the selection of test pieces and shall prepare these to the required shape and length and submit it to the laboratory where directed for tests at Contractor's cost. No steel shall be incorporated in the Works without prior approval of the Engineer.

f) **Admixture**

i) The Engineer shall select the source and brand of air-entraining admixture, if required. The air-entraining admixture will be an approved substance or compound conforming to the requirements of ASTM Designation C260-01, "Standard Specification for Air-entraining Admixtures for Concrete", which will produce entrained air in the concrete as hereinafter specified. The air-entraining admixture shall be added to the batch in solution in a portion of the mixing water. This solution shall be batched by means of mechanical batcher capable of accurate measurement and in such a manner as to

ensure uniform distribution of the admixture throughout the batch during the specified mixing period.

ii) The source, brand and types of suitable water-reducing cement-dispersing admixtures, if required, shall be selected by the Engineer. The water-reducing admixture will be compatible with the air-entraining admixture specified above and shall be batched and added to the concrete in the manner specified for the addition of air-entraining admixture but separate from the portion of the mixing water containing the air-entraining admixture. The quantities of water-reducing cement-dispersing admixture to be used shall be in accordance with the instructions of the Manufacturer, as approved by the Engineer. Water-reducing admixture will conform to the requirements of ASTM Designation C494-99a "Standard Specification for Chemical Admixtures for Concrete". Water-reducing admixtures shall be sampled at the source of supply and tested at the expense of the Contractor. Additional tests if deemed necessary shall also be arranged by the Contractor without any claim of cost under the supervision of the Engineer.

iii) Admixture for non-shrinking of concrete shall be used for grouting wherever required.

g) **Mortar**

Before placing the fresh concrete a mortar cost, approximately two cm thick, shall be placed on construction joint. The proportion of the mortar mix shall be one part of cement to two parts of sand of fineness of between No. 100 and No. 4 sieves, with a consistency which allows spreading it over the surface and completely filling of all irregularities in the old concrete. Before concrete is placed over a construction joint, the joint shall be thoroughly cleaned and wetted. Any excess water shall be removed prior to concreting.

2) **Storage of Materials**

a) **Storage of Cement**

i) Cement shall be stored separately for each type in either silos or damp-proof warehouses.

ii) Silos to store cement shall be built or equipped with suitable means so that cement will not be retained at the bottom without being conveyed out.

In case of sacked cement, it shall be stacked on the floor rising atleast 30 cm from the surface of the ground, and shall be stored in such a manner as to facilitate conveyance and inspection. Height of each stack shall be at most 13 sacks.

iii) Any bag for which portion of cement has hardened during its storage shall not be used at all. Cement stored for long period shall be tested for its quality prior to its use.

iv) Cement with excessively high temperature shall be used only after lowering the temperature.

b) **Storage of Aggregate**

i) Fine aggregate, coarse aggregate and other aggregate of different type and grading shall be separately stored with dividers between each.

ii) When receiving, storing and handling aggregate, facilities shall be well maintained and handling shall be carefully performed so that no segregation o large particles from small ones may occur, no foreign materials may become mixed, or in case of coarse aggregate, no particles may be crushed.

iii) Storage facility of aggregate shall be equipped with a suitable drainage system, and shall have a suitable capacity so that the aggregate with uniform surface water may be used separately and the aggregate received may be used after being tested.

iv) In hot weather, aggregate shall be stored in a place with a facility to avoid direct exposure to the sun etc. so that extreme drying or temperature rise in the aggregate does not occur.

c) **Storage of Reinforcement**

Reinforcement shall not be directly placed on the ground, and it shall be stored in a warehouse or a place with suitable cover.

d) **Storage of Admixture**

i) Admixture shall be stored so as to be free from dusts and other impurities. Admixture in powder form shall be stored in such a manner that absorption of water and hardening are prevented and admixture in liquid form shall be stored in such a manner that segregation and change in quality are prevented.

ii) Admixture material shall be carefully handled.

iii) Admixture material shall be stored in silos or warehouses which are damp-proof and shall be used in the same order as they are received.

iv) Admixture stored for a long period or found to have changed shall be tested prior to its use. Should it be found in the test that admixture does not possess the required characteristics, its use shall not be allowed.

5.3 Mix Proportions

1) Mix proportion for concrete shall be determined in such a manner that the unit quantity of water is minimized while the required strength, uniformity, durability, water tightness and the workability suitable for the work are secured.

2) As there is a wide difference between the concrete test sample preparation methods used in the Laboratory and the actual practices used in the field for batching, mixing, placing, compacting and curing of concrete, the initial Mix Proportions shall be decided by the Engineer keeping in view the Mix Proportions already being used at different similar projects.

3) Keeping in view the Mix Proportions already being used for the similar projects, the scheme of mix proportion shall be submitted to the Engineer for approval. The form of submission as per Table-4 shall be used. The design strengths of the concrete shall be the classes indicated below.

o28 = 350 kg/cm² For grouting under base plate of equipment steel structure

o28 = 280 kg/cm² For water retaining structures.

o28 = 211 kg/cm² For foundation and buildings

o28 = 71 kg/cm² For leveling concrete.

Where o28 means concrete compressive cylinder strength at the age of 28 days.

The Contractor shall prepare concrete mix design according to basic design data for mixing as indicated in the Table-1 herein.

Table-4 (Concrete Mix Design Report)

					Quantity (per Mixed 1m³)				
Mix Size of Aggregate	Slump (cm)	Air-Entrainment (%)	Max Water/ Cement w/c (%)	Sand percent s/a (%)	Water (W) kg	Cement (C) kg	Fine Aggre. (S) kg	Coarse Aggre. kg	Admixture gm/cm³

Note: The quantity of admixture shall be indicated in cm³ or gram without solution or dilution.

5.4 Batching

Each material to be used in concrete shall be obtained through batching.

1) **Batching Equipments**

a) Batching method and batching equipment for each material shall be subject to the approval of the Engineer in advance.

b) Batching equipment for each material shall be inspected and adjusted if necessary, prior to the commencement of the construction work and periodically during the construction.

2) **Batching of Materials**

a) Batching shall be made in accordance with the mix design approved by the Engineer. Test for surface water of the aggregate shall be in accordance with relevant ASTM Designation of equivalent or as directed by the Engineer. Test for the quantity of the effective absorption of water, in case of dried aggregate, shall be as directed by the Engineer.

b) Volume of one batch shall be determined as directed by the Engineer.

c) Each material shall be batched by weight and/or by volume as approved by Engineer except the water and the solution of admixture, which may be measured by only volume.

d) Error in the measurement in each batch shall be within the permissible error range given n Table-5.

Table-5 Permissible Error in Measurement

Type of Materials	Permissible Error (%)
Water	± 1
Cement & admixture material	± 2
Aggregate	± 3
Solution of admixture agent	± 3

5.5 Mixing

Materials for concrete shall be thoroughly mixed until the mixed concrete becomes uniform in quality
.

1) **Mixers**

a) Mixers shall be either tilting batch mixers or forced batch mixers

b) Any concrete mixers to be used under this project shall be subject to approval of the Engineer.

c) Mixers shall be such that they will not cause any separation of materials at the time of discharging.

2) **Mixing**

a) When charging a mixer, all the materials shall be charged uniformly and simultaneously in principle.

b) Mixer shall be rotated at a speed recommended by the manufacturer.Mixing time shall, in principle, be determined based on tests. As a standard, it shall be at least 1 minute and 30 seconds for tilting type mixers and 1 minute for forced mixers.

c) Mixing shall not be continued for more than three times the specified mixing time.

d) Materials for new batch shall not be charged into the mixer until all the concrete in the mixer is discharged.

e) Mixers shall be thoroughly cleared before and after their use.

f) Concrete which is left mixed and has commenced setting shall not be used after re-tempering.

g) Hand mixing shall not be allowed

5.6 Conveying and Placing

1) **General**

a) Prior to the commencement of the construction work, a plan o conveying and placing shall be made, and this shall be subject to the approval of the Engineer.

b) Concrete shall be conveyed by methods which will prevent separation and loss of materials, shall be placed immediately and then, shall be thoroughly compacted. Even when it is impossible to place the concrete immediately due to some special reasons, the time between mixing and the completion of placing shall not exceed 30 minutes.

c) When segregation is observed in concrete during its delivery or placement, it shall be made uniform in quality by remixing.

2) **Conveying Equipment**

Equipment's to be used in conveying concrete shall be those which can easily deliver the concrete to its required place. Should the delivery distance be long, they shall equipped with such facility as an agitator.

3) **Buckets**

Structure of buckets shall be such that they will not cause any separation of materials when charging or discharging concrete, and that the concrete can be easily and swiftly deposited from them.

4) **Conveyer Belts**

Should conveyer bolts be used, they shall be suitably located so that they will not impair the quality of the concrete and the end of the line shall be provided with baffle plates and an elephant trunk so that the segregation of concrete can be prevented.

5) **Buggies and Trolleys**

Should buggies or trolleys be used, a level runway or path shall be constructed so that separation of material will not occur in conveying concrete.

6) **Chutes**

a) Should any chute be used, it shall be drop-chute in principle. The drop chute shall be connected to an elephant trunk so that the separation of materials is minimized.

b) Open chutes may be used, only when approved by the Engineer. Each open chute shall be inclined at uniform angle all along its length and the slope shall be such that it will not cause any separation of materials of the concrete to be placed. The distance between the bottom end of the chute and the surface on which concrete is to be deposited, shall be at most 1.5 m. The discharging end shall be equipped with a suitable elephant trunk.

7) **Preparation of Placing**

a) Prior to the placement, the arrangement of reinforcement, forms etc. shall be approved by the Engineer.

b) Prior to the commencement of the placement, it shall be certified that conveying equipments and placing equipments are in conformance to the plan of placing specified in clause…….

c) Prior to the placement, conveying equipments, placing equipments and the inside of forms shall be thoroughly cleaned to prevent foreign materials from being mixed into the concrete. Portions expected to face concrete and to absorb water shall be moistened in advance.

d) Water in pits and sumps shall be removed prior to the placement of the concrete. Suitable protective measures shall be taken so that water running into these pits and sumps will not wash the concrete just placed.

8) **Placing**

a) Concrete shall be placed in accordance with the plan of placing specified in clause …… should it be inevitable to change the placing method,. it shall be so done as directed by the Engineer.

b) When concreting is done in hot weather, special attention may absorb the water in concrete shall be given to the materials, placement, curing etc.

c) Portions such as the ground and foundations which may absorb the water in concrete shall be thoroughly wetted prior to the placement of concrete.

d) Temperature in concrete at the time of placing shall be at most 25 deg. C for gantry foundations and 32 deg. C for equipment foundations and other structures. If the temperature goes up, precautionary measures approved by the Engineer have to be taken.

e) Conveying equipments for concrete shall be such that they will protect concrete from being dried or heated.

f) Concrete shall be protected as soon as the placement is completed or interrupted. Special care shall be exercised to keep the surface of the concrete moist.

g) During the concreting operation, attention shall be paid not to disturb the arrangement of the reinforcement.

h) Concrete shall be placed in such a manner that it will not be required to be moved after being deposited.

i) Should any notable separation of materials be observed during concreting, the concrete shall be remixed to obtain the uniform quality and necessary measures to prevent separation shall be taken before the placing operation is resumed.

j) Concrete for one section shall be placed continuously until it is complete.

k) Concrete shall, in principle, be placed in such a manner that the surface of the placed concrete will be horizontal within the section. One lift in placement shall be at most 30 cm, in principle, if the length of the vibratory rod is larger than the concrete lift.

l) Should concrete be placed in layers, each succeeding layer shall be placed while the one below it is still plastic. Should it become necessary to place concrete on top of layer which has started setting, it shall be done in accordance with clause. ……

m) When height of the form work is great, it shall be provided with openings for concrete placing or the placement shall be done using droop chutes in order to prevent the concrete from being segregated or from adhering to the reinforcement or to the forms above the layer to be placed.

n) The height of the end of buckets and hoppers shall be at most 1.0 m above the level of placement.

o) Should there be any water coming out and accumulated during the placement, the concrete shall not be placed further until the water is removed by suitable means.

p) When concreting high structures such as walls and columns continuously, the consistency of the concrete and the rate of lifting shall be controlled, in such a manner that separation of materials during the placement and the compaction is minimized.

5.7 Compaction

1) In principle, internal vibrators shall be used to compact the concrete. When it is difficult to use internal vibrators in the case of thin walls suitable means shall be adopted. Vibrators to be used shall be subject to the approval of the Engineer.

2) Concrete, shall be thoroughly compacted immediately after placement, and shall be thoroughly worked around the reinforcement and into the corners of the form. Where conditions make compaction difficult, batches of mortar containing the same proportions of cement, sand and water as used in the concrete shall first be deposited to ensure the compaction.

3) When compaction is achieved by vibrators, it shall be inserted into the layer below the one just placed by about 10 cm. The vibrators shall be pulled out very slowly so that no hole will form I the concrete.

4) When concreting is to be compacted by internal vibrators the spacing and the time of their application shall be as directed by the Engineer.

5.8 Additional Placing

Should additional placing be made on top of a layer which has already started to harden, it shall be thoroughly and carefully worked on a directed by the Engineer so that the top and the lower layer becomes monolithic.

5.9 Curing

1) **General**

a) Concrete, after being placed, shall be sufficiently cured without being subjected to injurious effects caused by low temperature, drying, sudden change in temperature etc.

The Contractor shall report the said method to the Engineer and obtain his approval

b) Concrete shall be protected from vibrators, impacts and loads while it is hardening.

2) **Wet Curing**

a) Concrete being placed and compacted shall be protected form the sun, wind, showers etc. until it starts hardening.

b) Any exposed surface of concrete which has hardened to a degree that works can be done without impairing it shall be either covered with wet mats, canvas, sand etc. or directly watered and shall be kept moistened continuously for at least seven (7) days after the placement in case Ordinary Portland Cement is used.

c) When sheathing boards are expected to become dry, they shall be watered

5.10Joints

1) **General**

a) Location and structure of joints including expansion joints shall be as per relevant standards and codes and shall be shown and specified in the drawings.

b) Should any joint not specified in the design be made, its location, direction and method of construction shall be determined in the plan of construction so that it will not impair the strength and the appearance of the structure, and this shall be subject to the approval of the Engineer.

2) **Construction Joints**

a) Construction joints shall be located where the shear forces are minimum and with their faces in perpendicular, in principle, to the direction of compression in the member as approved by the Engineer.

b) Should it be unavoidable to make a construction joint at a location where large shear is acting, it shall be reinforced by forming tendons or grooves, or embedding suitable steel as approved by the Engineer.

3) **Construction of Horizontal Construction Joints**

a) Sides of the surface of a horizontal construction joint intersecting the forms shall be kept as horizontal and straight as possible.

b) When new concrete is placed, the surface of the old concrete shall be removed of all laitance, interior concrete, loosened aggregate etc. and shall be thoroughly wetted.

c) Prior to the placement of new concrete, the forms shall be tightened, standing water removed and either cement paste or mortar with the same mix proportion as in concrete shall be applied on the surface of the old concrete.

4) **Construction Method for Vertical Construction Joints**

a) When a vertical construction joint is to be made, the forms at the joint shall be rigidly supported and the concrete in the vicinity of the joint shall be thoroughly compacted by vibrators.

b) Fresh concrete shall be placed after the surface of the aged concrete at the joint is removed of the surface film or is roughened and thoroughly wetted or after the surface is treated as directed by the Engineer.

c) Fresh concrete shall be thoroughly compacted at the time of placement so that the fresh and aged concrete is in tight contact with each other.

5.11 Reinforcement Work

1) **Processing of Reinforcement**

a) Reinforcement shall be processed to the shape and the dimensions as shown in the drawings by a method which will not impair the quality of the material.

b) Reinforcement shall be processed in ordinary temperature. When it is unavoidable to heat for processing, the whole process shall be subject to the approval of the Engineer.

2) **Placing of Reinforcement**

a) Prior to fabrication and at time concrete is placed, reinforcement shall be thoroughly cleaned and free from must, oil, loose rust and any other non-metallic coatings which may impair the bond between the reinforcement and the concrete.

b) Reinforcement shall be accurately placed to the designated position, and shall firmly be supported so that it will not be dislocated during the placement of concrete. Erection bars, if required, shall be used for this purpose.

Important crossing of reinforcement shall be fastened by either annealed wire of at least 0.9 mm in diameter or binding wire.

c) Clearance between reinforcement and sheathing board shall be maintained correctly by use of spacers.

d) Reinforcement shall always be inspected by the Engineer before placing of concrete.

3) **Covering of Concrete**

a) The covering shall be at least one diameter of the reinforcement.

b) In general, the minimum covering shall be as shown in Table-6, unless otherwise noted on the drawings.

Table – 6 Minimum Covering (cm)

Conditions	Slabs, Walls	Beams, Columns
When not directly exposed to severe weather or ground	2.0	4.0
When effective coating is not applied on the portion which may be subjected to injurious chemical reaction due to smoke, acid, alkali, oil, deicing salts, brackish water etc.	5.0	6.5

c) In case of footings and important members of a structure, it is recommended that the covering be at least 7.5 cm when concrete is placed directly facing the ground, and at least 5 cm for bars with diameter or more than 19 mm and 4 cm for bars with the diameter of less than 19 mm when the concrete is buried and directly facing the ground or when it is subjected to severe weather conditions. However, the covering at the bottom side of slabs may be at least 2.5 cm even if the portion of it is subjected to extreme weather conditions.

d) The covering in structures which are required to be specially fireproof shall be determined based on the temperature of the fire, duration, characteristics of aggregate to be used etc.

5.12 Joints of Reinforcement

a) Lap joints of reinforcement shall be made by lapping the required lengths and fastening them together at several points with annealed wire of at least 0.9 mm in diameter. Lap length shall be according to ASTM Designations.

b) Reinforcement projecting from the structure and exposed for future jointing shall be protected from damage, corrosion, etc.

5.13 Forms and Timbering

Forms and timbering shall be so designed and constructed as to have the required strength and rigidity, to secure correct position, shape, lines dimensions of the structure and to secure the satisfactory quality in concrete.

1) **Design of Forms**

a) Forms shall be those which can easily be fabricated and stripped; joints of sheathing boards and panels shall be forced in parallel with or perpendicular to the axis of the member so that it will have to structure which is tight against mortar.

b) The structure form shall be such that the corners of concrete can be mould even hen it is not particularly specified.

c) Temporary openings, if necessary, shall be made at suitable locations to facilitate cleaning and inspection of the forms and the placing of concrete.

2) **Design of Timbering**

a) Suitable type of timbering shall be selected and the load carried by them shall be correctly transferred to the foundation by appropriate means.

b) As design of timbering for important structures is concerned they shall be subjected to the approval of the Engineer.

3) **Construction of Forms**

Stripping agents shall be applied on the inside of the sheathing board.

4) **Construction of Timbering**

a) Timbering shall be constructed so as to have sufficient strength and stability.
b) An amount of the settlement of the form works due to the weight of the placed concrete shall be estimated and a camber shall be introduced, if necessary, in the shoring.

5) **Removal of Forms and Timbering**

a) Forms and timbering shall not be removed until the concrete reaches a strength required to carry the concrete weight and the load applied during the construction work.

b) Time and sequence of the removal of the forms and timbering shall be subject to the approval of the Engineer.

Loading on a structure immediately after the removal of the forms and timbering shall be subject to the approval of the Engineer.

5.14 Finishing

1) **General**

When the uniform appearance should be obtained on the exposed surface, special attention shall be given to place the concrete for the predetermined section continuously without changing the materials, proportions and the method of the placement.

2) **Surface Note Facing Sheathing Boards**

a) Surface of the concrete compact and approximately leveled to the required level and shape shall not be finished until the water coming out ceases and is removed.

b) Cracks formed after finishing but before hardening shall be removed by tamping or re-finishing.

3) **Surface Facing Sheathing Boards**

a) Concrete which will be exposed shall be placed and compacted in such a manner that the surface solely composed of mortar will be secured.

b) Projections and lines formed on the surface of concrete shall be removed to ensure surface flatness. Honeycombs and chipped places shall be removed and the surface shall be moistened and patched with appropriately proportioned concrete or mortar to be finished flat.

c) Cracks formed after the removal of the forms due to temperature stress, drying, shrinkage, etc. shall be repaired as directed by the Engineer.

5.15 Tests

Contractor shall submit to the Engineer six copies of reports as directed by the Engineer.

1) **Test of Material**

a) All the materials (cement, water, fine aggregate, coarse aggregate, reinforcement, admixture, etc.) to be used shall be approved by the Engineer after the Contractor submits the test results.

b) The testing method shall comply with relevant ASTM Designation or equivalent.

2) **Tests of Concrete**

Materials of concrete, reinforcement, equipments, and workmanship shall be controlled to produce reinforced concrete of the required quality economically.

a) During construction the following tests shall be carried out as directed by the Engineer.

i) Slump test

ii) Temperature test

iii) Compression test of concrete

Samples for compression tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 100m3 of concrete, nor less than once for each 450m2 of surface area for slabs or wall.

b) In order to determine the suitability of the curing method and the time to remove the forms, and in order to certify the safety for early loading, strength tests shall be performed on specimens cured under the conditions as similar as possible to those of the concrete at the site. Should the result of the test indicate that the obtained strength of the specimen is much smaller than that of the specimens cured under the control condition, the method of curing at the site shall be changed as directed by the Engineer.

c) For compression test of concrete, minimum six (6) test specimens shall be required with a minimum of one set of sample per concrete, pour from a randomly selected batch of concrete, taken at point of discharge from mixer or truck, cured under standard conditions.

Three (3) specimens shall be tested for seven (7) or fourteen (14) days strength, the remained three (3) specimens shall be tested for twenty eight
(28) days strength.

d) Should it become necessary after the completion of the work, non destructive test of concrete or tests on concrete specimens cut out from the structure shall be carried out.

The expenses for the above tests shall be included in the unit prices.

3) **Control of Concrete by Compressive Strength**

a) Control of concrete by compressive strength shall be based on 28 days compressive strength. Specimens, in this case, shall be taken in such a manner that they will represent the concrete of the structure for at least each separate pour.

b) Test results of compressive strength to be used for the control of concrete shall generally be considered satisfactory if arithmetic average of strength tests for specimens taken from the same batch, equals or exceeds specified compressive strength and not individual strength test falls below specified compressive by more than, 35 kg/cm2.

4) **Inspection of Quality of Concrete**

a) The Contractor shall submit to the Engineer the results of the tests of concrete obtained according to the quality control test in the preceding paragraph 4.05.14. and obtained approval of the Engineer.

b) When the results of tests show that the strength of any concrete is below the minimum specified, Engineer may give instructions for the whole or part of the work concerned to be removed and be replaced at the expense of Contractor. The Contractor's Works which has to be removed and replaced as a result of the defective concrete. If any concrete is held failed, Engineer may order the proportions of that class of concrete to be changed in order to provide the specified strength.

5) **Test of Reinforcement Bars**

In the case where there is no test certificate of reinforcement bars (mill sheet) or in case the Engineer deems necessary, the Contractor shall carry out the characteristics and strength test of reinforcement bars and obtained approval from the Engineer for its use.

a) **Test Method**

Test method shall conform to the relevant ASTM Designation or equivalent, unless directed otherwise by the Engineer.

b) **Report**

The result of the tests shall be reported to the Engineer without delay.

5.16General

The inspection and tests specified herein shall include the following:-

a) Volume of work executed
b) Inspection and test of construction materials
c) Inspection of reinforcement bar assembly
d) Inspection of forms
e) Inspection of the lines, grades and dimensions of the structures
f) Identification test of the quality of concrete at site (cast-in-place concrete).

g) Other tests and inspections required according to pertinent regulations, codes and standards or as deemed necessary by the Engineer.

1) The following tests and inspections shall be executed in the presence of the Engineer.
   i) Strength test of reinforcement steel
   ii) Compression test of concrete
   iii) Other tests and inspections the Engineer deems necessary.

2) **Inspection of Reinforcement Bar Assembly**

Prior to placement of concrete, the Engineer shall inspect reinforcement bar assembly to confirm the classification and diameter of reinforcement bar, space between reinforcement, length of lap joint and covering etc. are according to the Drawings.

3) **Inspection of Forms**

Prior to placement of concrete, the Engineer shall inspect the form work and shall give approval for concreting.

4) **Inspection of the Dimensions of the Structure**

Inspection of the dimensions of the structures shall be made as required by the Drawings.

Concrete work shall not exceed, in general, the tolerance limits specified below:

a) Variation from plumb or specified batter for surface of stems and lines.

   i) In any 3.0 m of length 5 mm
   ii) Maximum for the entire length 15 mm

b) Variation from the level for slabs

   i) In any 3.0 m of length 5 mm
   ii) In any 6.0 m of length 8 mm
   iii) Maximum for the entire length 15 mm

c) Variation in cross sectional dimensions of stems and thickness of slabs.

   i) Minus 5 mm
   ii) Plus 10 mm

d) Variation and level specified at tope of foundations.

   i) Minus 10 mm
   ii) Plus 10 mm

e) Variation in protective covering of reinforcement steel.

   i) With cover of 40 mm or less -5 mm
   ii) With cover more than 40 mm -10 mm

f) Variation from effective depth of reinforcement steel. 20 mm

5.17CABLE TRENCH WORK

5.17.1 General

The Contractor shall provide all cable trenches leading from the outdoor equipment in the switchyard to the indoor equipment in the buildings as shown in the Drawings.

The design shall cover the following requirement.

5.17.1.1 The design of cable trenches shall be similar to the design shown in bidding documents and with draining system.

5.17.1.2 Cable trenches shall be made of complete monolithically reinforced concrete work. Each type of cable trench shall be provided with expansion joint at intervals of max. 20 linear meter.

5.17.1.3 All trench covers shall be of reinforced concrete to withstand a load of 300 kg at the centre except those at road crossing which should withstand a load of 5 tons at the centre.

5.17.1.4 The trench covers shall be of such size as to facilitate their handling by manual labour.

5.17.1.5 Trenches in substation will be built with the top of the trench cover 150 mm above the gravel level or as shown in the bid drawings.

5.17.1.6 The trenches shall be connected to a drainage system, designed and constructed by the Contractor in such a manner that sub-oil water due to water logging can not enter the trenches and rain water collecting in trenches is drained out efficiently. The drainage system for trenches shall be designed with proper slope for flow of water, entering the trenches.

5.17.1.7 All cable trenches shall set on a layer or leveling concrete of thickness 100 mm.

5.17.1.8 Cable trays shall be provided in trenches at adequate intervals horizontally and with sufficient vertical spacing between trays to freely accommodate the cables, Plenty of working space shall be provided for handing the cable during installation and maintenance.=

5.17.1.9 Each trench shall have two sections, one to accommodate cables for primary and other for secondary protection system. The later shall also accommodate power cables.

5.17.1.10 Trench-road & trench-trench crossings shall be culvert type and so designed that plenty of space is available for handling the cables during installation, future requirements of bays and maintenance at these crossings. Proper water drainage system shall also be designed on these crossings.

5.17.1.11 Trench entrances into the buildings shall be designed to seal off entry of any water or vermins and pests into the building through these entrances.

5.17.1.12 The trench covers shall be upper covers type for trench-road-crossings where embedded covers shall be used.

5.17.1.13 Small openings shall be provided in the walls of cable trenches as required for entry of cable carrying pipes during construction stage which shall be sealed later with appropriate sealing compound as approved by the engineer. The appropriate measures shall be adopted to protect these pipes against corrosion and damages. All joints of these pipes shall be properly sealed to prevent/ingress of subsurface water.

5.17.2 Inspection

The Engineer shall inspect the cable trenches as for the compliance of the specifications and drawings approved by the Engineer.

5.18OIL CONTAINMENT FOR TRANSFORMER, BUNDS, AND FIREWALLS

5.18.1 The Contractor shall provide all Transformer Foundations having provision to contain spillage/leakage oil and its drainage through steel pipe to the Oil and Water Separation Tank for disposal. Steel Grating and a layer of Gravel should also be provided under the Transformer for fire protection purpose.

5.18.2 Firewalls shall be provided in-between Transformers to save the Transformers from spreading fire.

5.19OUTDOOR STEEL STRUCTURES AND FOUNDATION BOLTS

The Contractor shall provide all Outdoor Steel Structures and Bolts as per following WAPDA/NTDC Specifications attached;

Steel Supporting Structures - P-182; 91 Fabrication of Steel Structures- P-139; 80 Steel Nuts & Bolts- P-19; 83

11kV Structure- P-34; 68

6. GRAVEL PAVEMENT WORK

The Contractor shall provide a blanket of river run gravel in the switchyard area along equipments foundation and as shown in the drawings.

A 200 mm layer of hard, durable, gravel shall be provided by the Contractor in the switchyard area around the equipments above the reference ground level. The size of gravel shall generally vary from 20 to 75 m. The material shall be placed to its full thickness of 200 mm in one layer and in such manner as to avoid displacing the under laying material. The material shall not be compacted.
The gravel shall conform to the following gradation limits, unless otherwise specified.

U.S. Standards Sieve Designation	**Percentage Passing by Weight**
(3 inch) 75 mm	100
(2 inch) 50 mm	85-100
(3/4 inch) 20 mm	0-100

Crushed rock shall not be allowed, the gravel which shows any sort of chemical reaction as per site conditions shall also be not allowed. Contractor shall get the approval of the source of supply from the Engineer prior to placement of gravel.

7. ROAD WORK

The Contractor shall prepare roads in the substation as shown on the drawings. Proper slopes shall be maintained.

7.2 Foundation for Road

1) **Sub-Grade Work:** Any excavation required for sub-grade construction shall be carried out in accordance with the respective provisions in the clause of earth work.

The materials required for banking and displacement shall be so placed that the finished thickness of one layer after compaction will become 20 cm or less.

2) **Sub-Base Course Work** The material to be used for sub-base course shall be as approved by the Engineer. The Contractor shall submit a report concerning the quality of materials and the method of sampling to the Engineer for approval.

3) **Testing:** The sub-grade surface shall be finished by proof rolling in order to obtain the contract pressure sufficient to permit smooth traffic of vehicles of 8 tons or over.

Should any defects be detected as a result of proof rolling, such defective sub-grade surface shall be finished again to the satisfaction of the Engineer.

4) **Inspection**

a) **Sub-grade:** The finished sub-grade surface shall be within ± 5 cm of the design elevation.

b) **Sub-base:** The finished sub-base course shall be within –10 mm and + 5mm of the design elevation.

7.3 Asphalt Concrete Pavement

1) **Material**

a) **Asphalt**

Bituminous material shall be used in the design of Asphalt Concrete Pavement Work.

The asphalt material shall conform to the requirements of AASHTO M-20, M-81, M-82 and M-40. The type shall be as directed by the Engineer.

b) F**ine Aggregate**

Fine aggregate passed a 2.5 mm sieve and shall be clean, strong, hard, durable, suitable graded and free from injurious amounts of dust, mud organic impurities, salts etc.

c) **Coarse Aggregate**

Coarse aggregate which retained on a 2.5 mm sieve, and shall be clear, strong, hard, durable, suitably graded and free from injurious amount of flakes, elongated pieces, organic impurities, salts etc.

Coarse aggregate for pavement shall comply with the following requirements.

i) Specific gravity more than 2.5

ii) Absorption value less than 3.0%

iii) Percentage wear less than 35.0%

iv) Soundness test less than 12.0%

v) Content of shale and soft less than 5.0% fragment of stone

vi) Content of slender and thin less than 25.0% fragment of stone

Note: Ratio of longer width and the other is more than three times, and on thin fragment ratio of thickness and width is more than three times.

d) **Filler**

Particles of stone means the material which was crushed a limestone or igneous rock and water content of filler shall be less than 1%.

Grading range of the filler shall comply with the following requirements.

Sieve	**Percentage Passing**
0.6 mm	100%
0.15 mm	90-100%
0.074 mm	70-100%

2) **Storage of Material**

a) **Asphalt**

Asphalt shall be stored in exclusive tank.

b) **Aggregate**

i) Storage facility of aggregate shall be equipped with a suitable drainage system

ii) Fine aggregate, coarse aggregate and other aggregate of different type and grading shall be separately stored with divides between each.

iii) When receiving, storing and handling aggregate facilities shall be well maintained and handling shall be carefully performed so that no segregation of large particles from small ones may occur, no foreign materials may become mixed, or in case of coarse aggregate, no particles may be crushed.

iv) During storage of fine aggregate, water contents should not change rapidly.

3) **Mix Proportions:** Mix proportions for the dense grade asphalt concrete shall be determined in such a manner that the test piece which conform stability flow value, percentage of void and degree of saturation by marshal testing of the asphalt volume at intervals of five percentage and submit such data in writing to the Engineer for approval.

Material for dense grade asphalt concrete, shall in principle, comply with the following requirements .

a) Thickness of surface shall be 5 cm

b) Maximum size of aggregate shall be 20 mm:

Material Size	**% age Passing**
25	100
20	90 - 100
13	75 - 90

c) Weight percentage of those passing a sieve:

Material Size	**% age Passing**
5	45 - 65
2.5	35 - 50
0.6	18 - 29
0.3	10 - 21

0.15 6 - 16
0.075 4 - 8

d) The volume of asphalt 5 – 7 %
e) Penetration test 80 - 100

Percentage of passing weight:
(on permissible error)

5 mm + 5 %
2.5 mm + 4 %
0.56 mm, 0.3 mm, 0.15 mm + 3 %
0.075 mm + 1.5 %
Percentage of asphalt volume + 0.3 %

4) **Working:** Asphalt concrete shall be placed on the clean and completely dry base course. The temperature in the working area shall not be less than 20 deg. C for at least one hour prior to the commencement of operations.

Asphalt concrete layer shall be compacted upto 95% maximum dry density. Curing period shall be minimum 24 hours and during this period no traffic shall be allowed to move on the road.

5) **Testing:** The marshal test shall be observed in the dense grade asphalt concrete for surface.

On standard values of marshal testing.

Soundness more than 600

Value of flow 20 – 40%
Porosity 75 – 85%

Submerged marshal retained more than 75% soundness

6) **Inspection:** Inspection of surface shall comply with following requirements.

Thickness of surface 10 – 15 % Profile index part of each work less than 5%

The mixture shall be spread uniformly, rolled and finished into the specified thickness. Then the finished surface shall be measured in parallel to the center.

7.4 Reinforced Concrete Pavement/Service Road

1) **Material**

a) Cement, water, fine aggregate and coarse aggregate shall be in accordance with the clause “Material for Reinforced Concrete”.
b) Water reducing agent shall conform to the standards for water reducing agent by relevant ASTM Designation or approved equivalent.
c) Reinforcement steel shall be deformed bars conforming to ASTM 615-96a grade –40 or equivalent as approved by the Engineer.
d) The Contractor shall submit the report of tests for quality of the materials as directed by the Engineer for his approval.
e) If on receipt of tests from laboratory any change is observed in material, the matter shall be referred to the Engineer for his approval.

2) **Concrete Mix:** The following requirements shall be observed in concrete pavement.

a) The bending strength at 28 days of concrete is 45 kg/cm^2 and this test shall, in principle, be performed in accordance with relevant ASTM Designation or approved equivalent.
b) Maximum size of coarse aggregate shall be 40 mm.
c) Consistency in concrete shall be less than 2.5 cm by slump test and initial setting time is 30 sec.
d) Air content shall be between 3 to 6 percent.

3) **Form Work** Form material shall be straight and have width for designed thickness of pavement which is more than 3m in length, and it shall be fixed on the position in accordance with the drawings.

4) **Detachment of Form:** It shall not be detached within 20 hours after concrete placing. However, if increase in concrete strength delays under certain conditions, approval of removing forms shall be given by the Engineer.

5) **Joint:**

a) The joints shall be provided at appropriate locations as per relevant standards

b) Flouring of joint shall be done after form is cleaned up and dried sufficiently.

6) **Placing:** Placing for concrete pavement shall, in principle, be in accordance with clause "Conveying and Placing of Reinforced Concrete".

7) **Installation of Reinforcement:** Mesh and reinforcement bar shall be set correctly at a position designated as shown I the drawings.

8) **Finishing:** Finishing of surface shall be done after leveling and compaction of concrete.

9) **Curing:** Curing of concrete pavement shall, in principle, be in accordance with clause "Curing" of Reinforced Concrete Work.

10) **Testing:** The Contractor shall submit to the Engineer six copies of report on these tests.

a) During placing of concrete following tests shall be carried out as directed by the Engineer.

i) Slump test

ii) Temperature of concrete

iii) Compression/bending test

The test of concrete shall be executed not less than once for each one hundred (100) cubic-meters of concrete to be poured on the same day with a minimum of one set of sample per concrete pour.

b) **Test of Material**

Coarse aggregate shall provide limit of wear reduction maximum 30 by Loss Angeles test of ASTM Designation.

11) **Inspection:** Finishing of concrete pavement shall meet the following requirements.

Profile index	Less than 10
Different from maximum height	Less than 3 cm Difference at two points picked up
arbitrarily at intervals of 20 cm.	Less than 1 cm

Joints shall not have the difference of more than 3 mm between adjoining pavement slab by measurement rectangularly against inclination with a 3 m ruler and the depth of any section shall not exceed 5 mm.

8. BRICK WORK

1) Prior to commencing the brick masonry work, the surface of brick shall thoroughly be cleaned and sufficiently moistened in order to ensure smooth adherence of mortar to the brick surface. Ist class bricks shall be used which shall be approved by the Engineer
2) The masonry joints shall in principle be 10 mm in thickness and mortar (1:3 c/s ratio or as shown in drawings) shall be filled sufficiently between each masonry joint in order to eliminate any void between brick and mortar.

9. DRAINAGE WORK

1) The drainage work shall be as described in the drawings and carried out in accordance with general provisions section ….. "Earth Work" and Section …… "Reinforced Concrete Work".

2) The water-plumbing facility for drainage shall be of such a system as not to cause any trouble against the surrounding area and structures. The Contractor shall submit the design and execution schedule for the water plumbing work to the Engineer for approval.

10. FENCE WORK

1) The design of fence shall conform to the drawing included in Volume-III of Bidding Documents.

2) The galvanized iron shall be used in accordance with ASTM Designation or equivalent.

3) Construction of fence, welding shall comply with ASTM Designation or equivalent.

11. BUILDINGS

The scope of work under this Contract includes all civil works of control house building and GIS halls including all its services and electrical equipment's requirements. Complete design and construction of buildings, construction of trenches in relay room, entry of cable trenches coming from switchyard, providing openings in RCC slab, providing supports for new panels, providing foundation channels for diesel generator and any other work necessary for meeting the specified requirements shall be the Contractor's responsibility. Buildings shall be designed according to Architectural Specifications and Structural Specifications.

11.1 ARCHITECTURAL SPECIFICATION

11.1.1 GENERAL

All the design and construction shall follow the Architectural Specifications and the space requirements for Relay Room, Control Room, Battery Room, Workshop, Lab; Office, Kitchen, Store etc. for Control House Building and GIS Halls as given in layout drawings. All building external walls shall be cavity walls having 50mm cavity between 230mm masonary & 115mm fair face masonary work for the purpose of heat proofing.

11.1.2 SCOPE OF WORK

The scope of work includes all the Architectural design and construction of control house building and GIS halls including all the facilities and EOT crane in the GIS halls.

11.1.3 MATERIALS

Concrete of different strength as specified for different works, Bricks, Fair Face Bricks, Ceramic Tiles, Rubber Tiles, Galvanized angle iron, steel gratings, trench cover plates, steel brackets, weather shield paints and all fixtures etc. shall include in the building materials.

11.1.4 CEMENT RENDERING

Cement Rendering of 1:4 externally and 1:5 internally shall be used wherever required.

11.1.5 ROOFING

Roofing for the buildings shall consists of 38mm thick brick tiles grouted in 1:2 cement sand mortar over 100mm thick well compacted mud laid to slope including 25mm thick mud mortar for pasting the brick tiles over 38mm thick closed cell polystyrene board (Jambolon board or equivalent) over 0.2mm thick polythene sheet over 2 coats of hot bitumen BP3 or BP4 over RCC Slab.

Terrace at First Floor

Porceline matt tiles over PCC over insulation over water proofing treatment shall be used as Terrace floor.

11.1.6 REINFORCED CONCRETE WORK

All exposed Concrete (RCC & PCC) surfaces shall be fair faced without plaster.

11.1.7 ALUMINIUM WINDOWS

Windows (sliding) to be of colored anodized aluminium using prime/delux sections (wall thickness 2mm). All accessories to be of imported highest quality. Clear glass 5mm thick best quality local make shall be used.

11.1.8 MAIN ACCESS DOORS TO SWITCHGEAR ROOM

Steel sliding doors M.S. angle frame with folded M.S. sheet heavy duty shall be used.

11.1.9 METAL DOORS AND FRAMES

Aluminium door frames (prime/deluxe sections wall thickness 2mm) with Aluminium or Tempered glass panels to be used.

11.1.10 DOOR HARDWARES

Imported door closers, locks and accessories (best quality) shall be used.

11.1.11 TILE WORK

Ceramic glazed tiles (min. size 250mm x 330mm (10"x13")) on walls and matt ceramic tiles on floors (best quality local make) shall be used.

11.1.12 RUBBER FLOOR TILES

Rubber tiles 500mm x 500mm x 5mm local best quality shall be laid with acid proofing imported adhesive (best quality).

11.1.13 ACOUSTIC CEILINGS

Imported water resistant (12mm thick) mineral fiber board Acoustic ceiling with standard suspension system.

11.1.14 MISCELLANEOUS METAL

Heavy gauge M.S. cable ladder with cable hangers, trench cover grills, roof access ladder etc.

11.1.15 BRONZE PLAQUE

Bronze Plaque bearing NTDC insignia including painting and fixing.

11.1.16 PAINTING

- Interior finish, 3 coats (ICI Dulux or equivalent) best quality local paint over properly prepared surface.
- Exterior finish all fair face & plastered surfaces to be provided with 2 coats of weather shield ICI (Dulux or equivalent) best quality local weather resistant.
- All exposed metal work to be provided with a coat of Red Oxide (ICI Dulux or equivalent) prior to two coats of enamel paint (ICI Dulux or equivalent best quality local make).
- Acid resistant paint in Battery Room & Exhaust Fans in battery room (ICI Dulux or equivalent best quality local make).

11.1.17 FACING BRICK WORK

- Facing Brick Work (if provided) 75mm x 50mm x 230mm (3” x 2” x 9”) brick tiles with appropriate masonary tiles laid with horizontal grooves 6mm thick, and without vertical grooves.

11.1.18 BATH ROOM ACCESSARIES

- Bath Room Accessories Fittings chromium plated best quality local make.
- Bath Room Fixtures, large size best quality local make.

11.1.19 FLOORING

- General flooring, Terrazzo finish.
- Steps, 25mm thick local marble.
- Bath Room Walls, glazed ceramic tiles.
- Bath room Floor, matt ceramic tiles.

11.2 STRUCTURAL SPECIFICATION

All the buildings should be of RCC frame structure buildings having specified concrete and reinforcement strengths and other concrete work specifications.

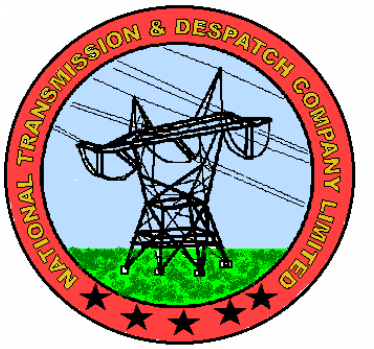
12. PREPARATION OF SITE AREA AND DISMANTLING WORK

A number of partially constructed foundations are existing in the 500 kV switchyard area and area in which new 220 kV bays are to be constructed under this Project. The Contractor shall investigate if these partially constructed foundations can be used and submit detailed report in this regard. However, the Contract Price shall be deemed to include the cost of complete dismantling of existing of civil works and construction of new foundations. Use of existing civil works or part thereof by the Contractor will be subject to approval of the Engineer and in such case the Contract Price will be adjusted appropriately.

The Contractor shall also dismantle the concrete structures/foundations inside the outside the foundation area which are not required, cut the projecting reinforcing bars and fill up the excavated pits to level the area.

DRAFT

SPECIFICATION P-



ERECTION , TESTING & COMMISSIONING

DESIGN DEPARTMENT (NTDC)

Draft
ERECTION, TESTING AND COMMISSIONING

0. GENERAL

The Contractor shall complete the erection, testing and commissioning of the substation and shall hand over in proper working order in accordance with the Contract Documents. All work of assembly, construction and erection shall be done in a neat, first class workmanship manner according to the best practice applicable and as approved by the Engineer.
The Contractor shall submit a detailed description of the field tests he intends to carry out on his equipment, comprising test protocols, testing and commissioning procedures etc. for Engineer's review well before starting of the field tests.

The Contractor shall be responsible for satisfactory field testing and commissioning of equipment to the satisfaction of the Engineer prior to the energization. Engineer may also ask the Contractor to perform additional tests, which may not be listed to prove that a particular equipment is fit for commissioning and energization.

A record of all performance tests shall be embodied in a report to be submitted by the Contractor upon completion to the satisfaction of the Engineer of the tests described herein together with such other tests as may be agreed between the Contractor and the Engineer, which collectively shall constitute the Commissioning Tests.
The Engineer may at his option require that tests be made after the equipment has gone into service in order to demonstrate that all performance guarantees have been met. The Contractor will be permitted to have his representative present at his own expense and make all necessary corrections. Additional tests shall then be made under the directions of the Engineer to demonstrate to his own satisfaction the effectivness of these corrections have been satisfactorily made the conditions of the Contract shall not be considered fulfilled.
Upon completion to the satisfaction of the Engineer of the tests specified hereafter together with such other tests as may be agreed between the Contractor and Engineer shall collectively constitute the commissioning tests. The Contractor shall certify in writing to the Engineer that the equipment or part of the equipment has been installed and tested to the satisfaction of the Engineer and is ready for energization.
All instruments and test equipment required for complete installation testing and commissioning of plant shall be arranged by the Contractor.

1. ERECTION AND INSTALLATION

1.1 High Voltage Bus-works

1) General

The Contractor shall install the conductor, insulators and the hardware for strain and tubing buses and overhead shield wire in accordance with approved drawings.

2) Conductor and Buses

Buses, which are used in tension, shall be free of joints or splices. All bus connectors shall be clamped firmly and locked securely. The equipment and methods used for stringing the conductors shall be approved by the Engineer and shall be such that the conductor will not be damaged during the stringing operation.

Tubing's used bus work and connections to equipment shall be shaped and formed prior to installation to reduce the possibility of damaging equipment terminals. All tubing shall be installed in such a fashion that stresses between connecting terminals will be reduced to a minimum. If connection is made to the equipment on another foundation or structure then the tubing shall have flexible connectors at one end.

The radius of tubing bends shall not be less than four times the diameter of the tubing, and such bends shall be free from links indentations, or flattened surfaces. Tubing shall be utilized in such a manner as to minimize the necessity of splicing. Splicing will not be allowed unless unavoidable. All terminals shall be bolted securely and locked. All connections shall be thoroughly cleaned to remove oxide film. An oxide-retarding compound of approved type shall be used at all connections and precautions shall be taken to seal moisture out of the joint to avoid galvanic corrosion.

1.2 Transformers and Shunt Reactors

1) Installation

The transformers and shunt rectors shall be assembled on their respective foundations in strict conformity with manufacturer's erection manuals and approved drawings.

While assembling, precaution shall be observed to prevent condensation on any part within the tank. The tank and the neutral shall be grounded as specified.

While bushing holding down bolts shall be properly tightened to avoid unequal clamping strains and subsequent damage to the bushing porcelain or support.

2) Wiring

Connection to oil and winding temperature gauges and oil level indications shall be with control cable run through conduit from cable trench to the cabinet or terminal boxes.

3) Oil Filling

The oil shall be passed through filter press and shall be cleaned and dry before filling the transformers and reactors under vacuum. It shall be ascertained that no contamination takes place during oil filling.
In case the gas has leaked from transformers and reactors, which shall be supplied inert gas filled during shipment drying out under vacuum shall be done by a suitable drying process.

1.3 Circuit Breakers

The circuit breakers shall be assembled placed leveled aligned and grouted on their concrete foundations and connected in accordance with approved drawings.

The circuit breaker control panels shall be factory wired. The control and power cables shall be terminated at terminal blocks. Connections to control mechanism shall be with control cables running through conduit from cable trench to mechanism cabinets.

1.4 Disconnectors

The Contractor shall assemble mount and connect all gang operated switches. Each pole of the disconnector shall be installed so that the base shall not be stressed unequally when bolted to the supporting member. The poles of the disconnector shall be aligned accurately and leveled on the supporting steel structures and shall be adjusted to permit a smooth and completely controlled movement through the entire operating cycle.

The bearing and the operating mechanism shall be lubricated properly. All contacts of the switches shall be adjusted and aligned for proper contact pressure and coated with corrosion inhibiting grease.

1.5 Surge Arresters

Surge arresters shall be mounted as close as possible to the apparatus being protected.

1.6 Instrument Transformers

Instrument transformers shall be mounted and connected in accordance with standard practice. Secondary connections to current transformers shall be made with minimum 6 sq mm. Conductors and to voltage transformers with minimum 4 sq

mm. Conductors.

The connecting cables shall run in metallic conduits from trench/duct to instrument transformers.

1.7 Control and Protection System

Control and relay panels shall be erected on channel iron bases. The channel irons shall be leveled and grouted in place and the control board and relay board panels mounted thereon. The Contractor shall mount all equipment and shall make all necessary connections and interconnections to the panels in accordance with the approved standard practices.

All instruments and relays shall be properly installed connected and tested to meet the technical specifications in the presence of the Engineer.

1.8 Fault Recorder and Sequential Event Recorder

The assemblies shall be securely mounted. AC mains shall be routed through appropriate system power filter and auxiliary disconnecting devices. Care shall be taken to obtain requisite clearances between assemblies and different components in an assembly. Provisions shall be made for free conversion air flow to prevent heat build up in the immediate vicinity of any unit. Operational tests shall be made to confirm the calibration to meet the needs.

1.9 Telecommunication and SCADA Systems

Proper care shall be taken to avoid mechanical joints, shocks or vibrations to the equipment. If any soldering etc. on site is necessary the person making these connections and tools will be properly grounded during the entire operation. Commissioning shall include operational tests to verify all possible modes of operation of SSB, protection and switching equipment. Signal to noise ratios will be monitored and demonstrated to be equal or better than design values.

1.10 Control and Small Power Cables

Cables shall be installed on cable supports, in cable trenches or in conduits., Cables shall be installed with sufficient slack to allow for expansion and contraction and tied at each support point. If laid in trenches, the cables shall rest on cable supports suitably spaced and shall be fastened at appropriate points, using bolted galvanized straps, which should not press tightly against the insulation.

Where group of cables enter or leave the trench, each shall be identified with stenciled metal tags. Each tag shall indicate the major equipment to which it is attached. At each cable termination the cables shall be clamped below the terminal block. Cable glands of appropriate sizes shall be used at cable entrances into control panels, relay panels of and marshalling boxes. The cable glands shall have provision for grounding the earth shielded cables. The jackets shall be stripped back and individual conductors trimmed to fit. Insulation shall be cut square and terminals installed without damage to insulation by over heating or abrasion.

Cables runs shall be continuous from terminal to terminal , to the extent permitted by available commercial lengths. Splicing shall not be permitted.

Insulated wire and cable shall be handled with care so as to avoid kinking and damage to insulation and outer jackets. Cables shall not be bent around a radius less than that recommended by the manufacturer.

Each wire terminating in a terminal block shall carry a permanent identification tag (ferrule) bearing the same identification number as given on the drawings. Slip-in-type ferrules should not be used for this purpose.

The Contractor shall install all lugs, terminals blocks and terminals required and shall make all connections required to provide a complete installation ready to operate. Cable identification tags of permanent type shall be provided and installed on both ends of each power and control cable.

Connections in lighting wires and cables shall be insulated with layers of plastic insulating tape or with high grade rubber tape over which friction tape shall be applied.

Sufficient slack shall be allowed in each run where a number of cables or wire comprising a circuit are trained through a pull box, terminal box trench or tray and shall be neatly placed and tied together. Lacing shall also apply from the point of leaving a cable tray or raceway to the point of attachment on the terminals of the switchgear, switchboard or other devices unless the run is in conduit.

1.11 Switchyard AC Power and Lighting

The Contractor shall install all required lighting, power and auxiliary apparatus, cables and make all connections. Illumination level of the installed lighting fixtures shall be measured according to the specified levels.

1.12 AC & DC Auxiliary Supplies

The Contractor shall install and connect the equipment under these specifications as specified in Section-20.

2. TESTING AND COMMISSIONING

2.1 HV Bus work/Equipment Connections

1) Verification of tightness of nuts/bolts as per the recommended torque.

2) Verification of sag and tension of the overhead conductors

3) Measurement of contact resistance of the HV connections

4) Thermo-vision survey of the HV connections after energization at high voltage

5) Check of visible corona after energization

2.2 Transformers and Shunt Reactors

The operating mechanism and control circuits of the on-load tap changer and forced air-cooling equipment shall be tested for proper operation and for tap changer position indications. All tests shall be made from the remote control points as well as the local control points.
Tests, performed to the satisfaction of the Engineer, shall include, but not limited to the following:

a) Drying shall be performed. The method and tests shall be subjected to the approval of the Engineer

b) Final sample testing of the insulation oil, after the completion of the dehumidifying and degassing process to ascertain specified chemical and physical characteristics

c) Oil insulation test

d) Winding insulation resistance tests

e) Insulation power factor test

f) Low voltage ratio test on each position of the tap changer

g) Zero sequence impedance test

h) Functional test for auxiliary equipment, buchholz relay, thermal relay, oil level indicator etc.

i) Adjustment of the protective devices such as gas and oil temperature relays and system to show compliance with operating requirements, correct operation verification of oil-preservation and oil-protection system.

j) Phasing test

k) Vector group test

l) Operational test for automatic tap-changing equipment, adjustment of the protective devices such as gas and oil temperature relays and system to show compliance with operating requirements, correct operation of complete cooling system and verification of correct operation of oil-preservation and oil-protection system.

m) Checking the oil leaks

n) Measurement of winding resistances

o) Verification of all alarm, trips and control circuits

p) Energization to full voltage

2.3 Circuit Breakers

a) Measurement of insulation resistance (Megger test)

b) Measurement of air content and humidity in SF-6 gas in the cylinder before its filling into the breaker

c) Measurement of air content in SF-6 at appropriate intervals after filling in the breaker

d) Recording of humidity content of the SF 6 gas at appropriate intervals after filling in the breaker

e) SF 6 leakage tests

f) Verification of AC and DC auxiliary supplied in respect of magnitude and phasing/polarity

g) Verification of pick-up and drop-off of each of the SF6 pressure switches at rising and dropping pressures

h) Verification for each hydraulic/pneumatic pressure switch in respect of pick-up & drop-off

i) Verification of operation of pressure relief valves

j) Verification of pressure thresholds for pump start/stop, breaker automatic tripping/blocking/lockout of close, trip and auto-reclose operation

k) Measurement of starting and running currents and direction of rotation of hydraulic/pneumatic pump/compressor motors

l) Measurement of time to reach the pump cut-off pressure

- From zero pressure
- After close operation
- After open operation
- After CO operation
- After O-C-O operation

m) Measurement of loss of hydraulic pressure over 24-hour period

n) Measurement of current in the tripping/closing coils

o) Measurement of operating times:

- Measurement of operating time at minimum, nominal and maximum DC supply voltage
- Measurement of operating times at maximum nominal and minimum hydraulic pressures
- Measurement of time for “O”, “C”,”CO” and “O-C-O” operations

While performing the timing tests, in addition to the numerical printout, traces of contact travel and close/open positions i.e. graphical recording of times should be appended to the test reports.

Timing of each interrupter and each pre-insertion resistor shall be separately recorded and shall be graphically visible on the timing strips.

p) Verification of pre-insertion time of closing resistors

q) Verification of time variation between openings of series contacts on any one phase

r) Verification of time variation between openings of contacts of any two phases

s) Measurement of contact resistance

t) Verification of functioning of auxiliary contacts

u) Verification of setting of the hydraulic/pneumatic motor thermal protection relay by secondary injection

v) Verification of functioning/calibration of every timing relay used in the control system

w) Verification of trip free operation and pole discordance functions

x) Functional tests in respect of local/remote controls, interlocking, anti-pumping, annunciation, fault & events recording, SCADA functions etc.

y) Functional tests of heating and lighting for the panels and cubicles

z) Verification of grounding connections and continuity

aa) Check of visible corona after energization

2.4 Disconnectors / Earthing Switches

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC and /DC auxiliary supplied in respect of magnitude and phasing/polarity

c) Verification of mechanical adjustments. Field measurements should be compared with the manufacturer’s recommended adjustments and tolerances

d) Measurement of contact resistance of the main contacts

e) Verification of limit switch operation

f) Verification of operation of auxiliary switches

g) Measurement of operating times for opening and closing operations

h) Measurement of starting and running currents of motors of disconnecting and earthing switches at minimum, nominal and maximum auxiliary supply voltage.

i) Verification of functioning of motor protection devices by secondary injection

j) Functional tests in respect of local/remote controls interlocking, annunciations, fault & event recording, SCADA functions etc.

k) Functional tests of panels/cubicles humidity control, ventilation, internal illumination

l) Verification of grounding connections

m) Check of visible corona after energization

2.5 Surge Arresters

a) Test of insulation resistance:

- HV-Ground/Base
- Base Ground

b) Verification of grounding connections and continuity

c) Measurement of ground resistance

d) Verification of surge counter operation

e) Functional tests of surge arrester remote signaling, annunciations events and fault recording

f) Measurement of leakage current with leakage current analyzer subsequent to energization of surge arrester

g) Check of visible corona after energization

2.6 Current Transformers/Bushing Current Transformers and Current Circuits

a) Verification of insulation resistance (Megger test):

- Primary to ground
- Each secondary winding to ground
- Primary to each secondary winding
- Between secondary windings

b) Measurement of winding resistance at each tap of each secondary winding

c) Measurement of capacitance and dissipation factor

d) Verification of winding polarities by flick test

e) Verification of magnetization characteristics and knee-point voltages

f) Verification of ratios

g) Verification of current circuits

Following checks and tests shall be made for the current circuits fed from the bay CTs transformer bushing CTs and reactor bushing CTs.

- Each CT circuit shall be verified for grounding at one point
- Phase-N loop resistance values shall be measured and recorded
- Loop resistance measurements shall also provide lead resistance values
- Resistance measurements shall be with wheatstone bridge
- Verification of all current circuits associated with bay CTs and bushing CTs with primary injection

- Primary injection shall be carried out for at least the following combinations

EACH CT:

R-G
Y-G
B-G
R-Y
R-B

- Busbar 1 CT and Mid CT in series R-G

Y-G
B-G

- Busbar 2 CT and Mid CT in series R-G

Y-G
B-G

- Busbar 1 Protection Busbar 1 CTs of new bays (if more than one) in series

R-G
Y-G
B-G

- Busbar 2 Protection; Busbar 2 CTs of new bays of (if more than one) in series

R-G
Y-G
B-G

- Busbar 1 Protection: Existing bay CT and new bay CT in series (if applicable)

R-G
Y-G
B-G

- Busbar 2 Protection : Existing bay CT and new bay CT in series (if applicable)

R-G
Y-G
B-G

- Secondary current measurement at each test block shall include recording of current magnitude as well as relative phase angle.

- Burden volts across each CT core shall be recorded during primary injection.

- In addition to measurement of magnitude of current and its relative phase angle at each test block during primary injection, current in panels' internal wiring shall be checked.

- Change-over of current circuits in the bank selector kiosk and with selector switches in the pole selector kiosk shall be verified during these tests.

h) Verification of operation of protective devices at the final (fault) settings during primary injection

i) Dissolved gas analysis (D.G.A) and measurement of moisture content of oil samples from each current transformer for future reference

j) Functional tests of panel's/cubicle's humidity control, ventilation, internal illumination.

k) Verification of grounding connections and continuity.

l) On-load tests on current transformer circuits:

- Secondary current measurements at each test block in respect of current magnitude as well as relative phase angle.
- Measurement of burden volts across each CT core.
- Measurement of current magnitude in panels internal wiring.

m) Check of visible corona after energization.

2.7 **Coupling Capacitor Voltage Transformers (CCVTs)/Capacitor Voltage Transformers (CVTs)/Voltage Transformers (VTs) and Voltage Circuits**

a) Tests of insulation resistance (Megger tests):

- Primary winding -ground
- Primary to each secondary winding
- Secondary to ground and between secondary windings

b) Measurement of winding resistance at each tap

c) Verification of polarities:

In case polarity of CCVTs/CVTs/VTs windings cannot be verified with the flick test, phase angle meter shall be used to check the phase angle between the primary injected voltage and secondary output.

d) Verification of voltage ratio at each tap by primary injection

e) Capacitance of dissipation factor measurement

f) Verification of voltage circuits:

- Verification of grounding of each voltage circuits at one point.
- If voltage circuit associated with CCVTs/CVTs/VTs cannot be verified with primary injection, secondary injection shall be made from the terminal box of the voltage transformers.
- Measurement of related burden amperes for each core.
- Voltage selection for synchronizing system for each combination of circuit breakers' and disconnecting switches' positions shall be checked.

g) Functional tests on panels/cubicles' humidity control, ventilation, internal illumination.

h) Dissolved gas analysis (DGA) and measurement of moisture content of oil samples from each voltage transformer for future reference.
i) Verification of grounding connections and continuity.

j) On-load/post energization tests shall be in respect of voltage magnitude, phase angle and phase rotation at the rest blocks, voltage magnitude and phase rotation at the terminals of the major devices in the panels; measurement of burden current for each core.

k) Check of visible corona after energization

2.8 Control and Recording Equipment

1) Fault Recorders

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary supply magnitude and polarity/phasing
c) Verification of grounding connections
d) Verification of MCB's operation at settings of thermal/magnitude.

e) Verification of calibration of adjustable devices such as timers.

f) Verification of calibration of each analogue channel by secondary injection.

g) Functional tests of analogue channels.

h) Verification tests/triggering verification for each logic channel.

i) Verification of functioning of each peripheral device.

j) Functional tests of indications, alarms, annunciation.

k) Verification of battery back-up and power-down and power-up function of real time clock

l) Verification of time synchronization with local event recorder

m) Verification of time synchronization with remote time source i.e. radio time signals or GPS signals

n) Functional tests of panels/cubicles humidity control, ventilation, internal illumination

2) Event Recorders

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary supply magnitude and polarity/phasing

c) Verification of grounding connections

d) Verification of MCB's operation at settings of thermal/magnetic releases

e) Verification of calibration of adjustable devices such as timers

f) Tests to verify point programming and functioning of each input

g) Verification of functioning of each peripheral device

h) Verification of battery back-up and power-down and power-up function of real time clock

i) Verification of time synchronization with local event recorder

j) Verification of time synchronization with remote time source i.e. radio time signals or GPS signals

k) Functional tests to verify alarms, indications, annunciations.

l) Functional tests of panels/cubicles humidity control, ventilation, internal illumination.

3) **Control Boards**

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary supply magnitude and polarity/phasing

c) Verification of grounding connections

d) Verification of MCB's operation at settings of thermal/magnitude

e) Verification of calibration of adjustable devices such as timers

f) Verification of calibration of electrical indicating instruments:

- Calibration of each indicating instrument shall be verified by secondary injection
- Injected quantities shall correspond to 25%, 50%, 75%, 100%, 125% and full case of the instrument

* 100% Load Angle 0,+30.+60.+90.-30.-60.-90 degrees
* 50% Load Angle 0,+30.+60.+90.-30.-60.-90 degrees
* 25% Load Angle 0,+30.+60.+90.-30.-60.-90 degrees

g) Functional tests of controls. indications, alarms, annunciation

h) Functional tests of panels/cubicles humidity control, ventilation, internal illumination

i) On-load tests:

- Current circuits: Measurement of current magnitude, relative phase angle, burden volts.
- Voltage circuits: Measurement of voltage magnitude, phase angle, phase rotation and burden amperes.
- Directional checks of power meters.

4) **Metering Boards**

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary supply magnitude and polarity/phasing

c) Verification of grounding connections.

d) Verification of MCB's operation at settings of thermal/magnetic releases

e) Verification of calibration of each energy meter and MW/MVAR/Voltage recorder by secondary injection:

- Injected quantities for recorders shall correspond to at least 25%, 50%. 75%. 100%. 125% and full scale of the instrument

- For MW and MVAR recorders and energy meters, tests shall also be carried out for at least the following combinations of magnitude and power factor of the measurands.

* 100% Load Angle 0,+30.+60.+90.-30.-60.-90 degrees
* 50% Load Angle 0,+30.+60.+90.-30.-60.-90 degrees
* 25% Load Angle 0,+30.+60.+90.-30.-60.-90 degrees

f) Functional tests of panels/cubicles humidity control, ventilation, internal illumination

g) On-load tests:

- Current circuits: Measurement of current magnitude, relative phase angle, burden volts

- Voltage circuits: Measurement of voltage magnitude, phase angle, phase rotation and burden amperes

- Directional checks of power recorders and energy meters

5) **Outdoor Marshalling Kiosks and Cubicles**

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary supply magnitude and polarity/phasing

c) Verification of grounding connections.

d) Verification of calibration of adjustable devices such as timers.

e) Verification of MCBs operation at settings of thermal/magnetic releases.

f) Functional tests to verify alarms, indications, annunciations.

g) Functional tests of humidity control, ventilation, internal illumination.

2.9 **Protection Boards**

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary supply magnitude and polarity/phasing.

c) Verification of grounding connections

d) General tests on each protective device including contactors, timers, auxiliary relays etc. as per the manufacturers' recommended procedures and tests protocols

e) Verification of protective devices calibration at the final settings.

f) Verification of protective devices characteristics

g) Verification of MCB's operation at settings of thermal/magnetic releases

h) Functional tests of protective devices including operation of power swing blocking relays, auto-reclosers etc.

i) Functional tests of protection tele-signalling

j) Functional tests of complete protection schemes

k) Functional tests of indications, alarms, annunciations

l) Functional tests of panels/cubicles humidity control, ventilation, internal illumination

m) On-load tests:

- Verification of current circuits
- Verification of voltage circuits
- Directional tests
- Tests of differential protection by de-stabilising the current circuits

2.10 Telecommunication and SCADA Equipment

1) Power Line Carrier Equipment

a) PLC Terminals

- Measurement of insulation resistance (Megger tests)
- Verification of AC & DC auxiliary supply magnitude and polarity/phasing
- Verification of grounding connections.
- Verification of MCB's operation at settings of thermal/magnetic releases.
- Measurement/verification of oscillator and pilot frequencies
- Measurement/verification of transmit and receive frequencies
- Measurement/verification of transmit/receive frequencies difference
- Level adjustments for transmitter, tele-operation and telephony
- Automatic gain control (AGC) settings
- Frequency response equalization
- Preparation of AF-AF response curve for speech and data channels
- Return loss measurement
- Measurement of line attenuation
- Verification of signal to noise ratio

- Check of service telephone
- Functional tests indication, alarms, annunciation
- Functional tests of panels/cubicles humidity control, ventilation, internal illumination

b) **Protection Signaling Equipment**

- Verification of regulated power supply outputs
- Measurement of transmit and receive levels
- Check of commands' transmission
- Measurement of command transmission times
- Functional tests of command transmit and receipt counters
- Functional tests in conjunction with protection system
- Verification of remote tripping of breakers with direct transfer trip commands
- Functional tests of indications, alarms, annunciation

2) **SCADA Equipment**

a) Point to RTU local test for each tele-information point

b) Point to point test for each tele-information point utp the National Control Centre

3) **Miscellaneous Tests**

a) Performance of additional tests to verify characteristic(s) and functions, peculiar to the design of an equipment or system device installed at the substation/utilized in the telecommunication, protection signalling, SCADA systems shall be assessed at the detailed engineering and implementation stages.

b) Visual inspections of equipment and devices shall be carried out in respect of damage, labelling, alignment, dust proofing, sealing against vermin etc.

c) Humidity and vibration recording devices are fitted to the equipment and systems for monitoring during transportation. Recordings of these devices shall be inspected upon arrival/installation at the site. Copies of the recordings shall be made part of the site test books.

d) High voltage tests shall be performed on the equipment in accordance with the standards.

e) Applicable tests and verifications mentioned in the above sections and sub-sections shall be applicable to all the equipment and systems and specifically mentioned herein above but may be installed at the substations.

4) **Line Trap**

The following routine tests shall be performed in accordance with IEC Publication 60353:

1) Measurement of rated inductance of the main coil

2) Measurement of power frequency inductance of main coil

3) Measurement of blocking resistance and blocking impedance

4) Measurement of tapping loss and tapping loss based on the blocking resistance

2.11 **Control and Power Cables**

1) **MV Cables**

a) Verification of insulation resistance (Megger test)

- Core-Ground /shield/armour
- Core-core

b) Verification of core(s) continuity

c) High voltage /Dielectric tests

d) Verification of shield continuity and grounding

e) Verification of armour continuity and grounding

f) Verification of tightness of connections

2) **LV Cables**

a) Verification of insulation resistance (Megger test)

- Core-Core
- Core-ground/shield

b) Verification of core(s) continuity

c) Verification of shield/armour continuity

d) Dielectric tests: 2000V AC one minute

e) Verification of tightness of connections

2.12 **Grounding and Lightning System**

1) **Grounding System**

a) Visual verification of each grounding connection

b) Verification of tightness of grounding connections as per recommended torque

c) Verification of effectiveness of substation grounding system by an appropriate method commensurate with installation involving large mesh

d) Continuity tests of each grounding connection

e) Measurement of grounding resistance with earth resistance tester:

- Each neutral connection of transformer
- Each neutral connection of shunt reactor
- Each surge arrester connection
- Building grounding
- Panels and equipment inside the buildings

2) **Outdoor and Indoor Lighting System**

a) Measurement of insulation resistance (Megger tests)

b) Verification of AC & DC auxiliary/power supply magnitude and polarity/ phasing

c) Verification of grounding connections

d) Verification of mebs' operation at setting of thermal/magnetic release

e) Verification of automatic and manual switching

f) Measurement of circuit loading

g) Verification of illumination levels

h) Functional tests to verify alarms, indications, annunciations.

i) Functional tests of humidity control, ventilation, internal illumination

(3) **Outdoor And Indoor Power Sockets**

a) Measurement of insulation resistance (Megger tests)

b) Verification of grounding connections

c) Verification of mebs' operation at settings of thermal/magnetic release

d) Check of voltage magnitude and phase rotation for each three phase power socket

e) Check of voltage magnitude and correct phase connection for balanced load for single phase sockets

f) Functional tests to verify alarms, indications, annunciations

2.13 **AC and DC Auxiliary Supplies**

(1) **DC Distribution Boards**

Following tests shall be performed on mebs in the DC distribution boards

a) Verification of breakers'/mebs' operation at setting of thermal/ magnetic release

b) On-load tests:- Measurement of loading of each circuit

(2) **AC Distribution Boards**

Following tests shall be performed on MCBs in the AC distribution boards

a) Verification of voltage and phasing up to each outgoing breaker/ MCBs'

b) Verification of breakers'/MCBs operation at setting of thermal/magnetic releases

c) On-load tests:- Measurement of loading of each circuit

2.14 **Temperature Inside Panels, Cubicles, Marshalling Kiosks**

Recording of temperatures inside the panels, cubicles, marshalling kiosks have been energized with ac and dc supplies and all devices mounted therein have been in service for sufficient time.

Ambient temperature i.e. room temperature for indoor equipment, yard temperature for outdoor equipment to be recorded.

2.15 **Coordinated Functional Tests of Control, protection, Metering and Monitoring Systems**

(1) **General:** The set furnished by the Contractor under this Contract shall be subject to tests in the shop and at site in the presence of the Engineer for conformity to requirements of the Specifications. All tests shall be conducted in accordance with the appropriate codes for testing.

The diesel engine and AC generator shall be test-run continuously for 24 hours to ensure smooth running and satisfactory operation of the machines and accessories. Tests on the unit shall not be less than the minimum requirements of ISO standard Practices for equipment.

(2) **Generator:** Routine tests on the generator shall be performed. Routine tests shall include:

a) Resistance of armature and field windings

b) Polarity of field coils

c) Check of mechanical balance

d) Check of no-load field current or exciter field current

e) Voltage balance

f) Phase sequence

g) No-load saturation curve

h) Insulation and high potential tests

i) Over speed test at 125% speed for 1 minute

Where the generator is not completely assembled in the factory, tests (d) to
(i) above inclusive may be carried out with the generator coupled to Engine Test (a) to (d) shall also apply to the exciter.

(3) **Performance Tests:** At the conclusion of installation of the Emergency Diesel Generating Set at site, commissioning tests shall be carried out by the Contractor/Manufacturer to demonstrate the satisfactory operation of the equipment and to verify the guaranteed performance figures of the diesel unit. The tests shall comprises:

1) Preliminary tests on individual components.

2) Continuous one-hour heat run at 50% load rating in parallel with the system

3) Continuous one-hour heat run at 75% load rating in parallel with the system

4) Continuous one-hour heat run at 100% load rating in parallel with the system

5) Part load heat runs to demonstrate satisfactory operation and establish fuel consumption at the respective loads.

6) The tests shall also include:

a) Performance of governing characteristics and protective systems.

b) Starting characteristics of the units. The units shall start at least five (5) times in six (6) consecutive starting attempts.

c) Starting power requirements to demonstrate the ability of the machine to start the specified number of times without need to recharge the batteries

2.16 Miscellaneous

a) Performance of additional tests to verify characteristic(s) and functions, peculiar to the design of an equipment or system device installed at the substation/utilized in the

, protection, control ,metering and monitoring systems signalling, SCADA systems shall be assessed at the detailed engineering and implementation stages.

b) Visual inspections of equipment and devices shall be carried out in respect of damage, labelling, alignment, dust proofing, sealing against vermin etc.

c) Humidity and vibration recording devices are fitted to the equipment and systems for monitoring during transportation. Recordings of these devices shall be inspected upon arrival/installation at the site. Copies of the recordings shall be made part of the site test books.

d) High voltage tests shall be performed on the equipment in accordance with the standards.

e) Applicable tests and verifications mentioned in the above sections and sub-sections shall be applicable to all the equipment and systems not specifically mentioned herein above but may be installed at the substations.

g) The functional testing of fire protection shall be carried out on one transformer by means of external input to pressure and temperature/fire sensors.

LIST OF TESTS FOR 500/220 KV SUBSTATION EQUIPMENT

It is clarified that any other tests required for testing & commissioning and proper functioning of the equipments, which are not mentioned below, shall be carried out as per NTDC requirements and standard practice.

Tests for 220/500 kV Auto-transformer Measurement Tests

a) Measurement of dielectric strength of oil
b) Transformer's turn ratio (TTR) test
c) Measurement of winding resistance
d) Vector group verification & open circuit test
e) Diverter switch verification by short circuit test
f) Insulation resistance test
g) Bushing current transformers

Functional Test

a) Cooling system

   i) Testing from local cubicle
   ii) Testing from control room

b) Winding & oil temperature thermo-meters & indicators

   i) Oil temperature thermo-meter & indicator
   ii) Winding temperature thermo-meter & indicator

c) Buchholz & pressure relief valve
d) Oil level indicator
e) Tap changer control

   i) Individual manual control from local
   ii) Individual manual control from remote
   iii) Master follower control in manual/automatic mode

      a) Manual control
      b) Automatic control
      c) Parallel operation by SKB-30 relay
      d) Heating & lightning circuit

Tests for 220 kV Circuit Breaker

A. Preliminary checks before starting

B. Inspection & testing of compressed air system

a) Direction of rotation & starting/running currents
b) Re-charging time of compressor& pressure consumption tests
c) Verification of pressure switches threshold settings
d) Check of safety valve operation
e) Leadage test

C. **Testing of Circuit Breakers**

a) Measurement of contact resistance of the main circuit
b) Measurement of pick-up & drop-off values of SF6 pressure switches
c) Functioning of local/remote switch
d) Verification of anti-pumping feature
e) Verification of pole discrepancy feature
f) Opening/closing time measurement
g) Verification of auxiliary contact position
h) Checking of cubicle light & anti-condensation heaters

Tests for 220 kV Capacitor Voltage Transformers

a) Preliminary checks & visual inspection
b) Insulation resistance tests
c) Ratio & polarity test
d) Voltage circuits in control, protection & metering panels

Tests for 220 kV Current Transformer

a) Preliminary checks & visual inspection
b) Hi-Pot & insulation resistance tests
c) Hi-Pot test
d) I.R. test of secondary windings
e) Ratio, polarity & wiring test by primary injection

Tests for 220 kV Disconnecting/Earth Switch

a) Preliminary checks before starting
b) Measurement of safety clearances/distances
c) Measurement of insulation resistance or Hi-Pot test
d) Operation tests
   i) Manual opening & closing operation - verification
   ii) Close/open operation from local/remote position
   iii) Opening/closing test under maximum/minimum supply voltage
      - Under max. voltage
      - Under min. voltage
e) Auxiliary contacts commutation – verification
f) Additional tests for earthing switch

Tests for 145 kV Circuit Breaker

a) Preliminary checks & visual inspection
b) Operational tests
   i) SF6 density meter
   ii) Spring charging time
   iii) Closing – opening operation
   iv) Anti-pumping feature
   v) Manual operation
   vi) Closing opening time measurement
   vii) Functional lock out

viii) Panel heating & lighting

c) Functional Tests

i) Alarm & indication circuits
ii) Interlocking scheme

- For line controlling circuit breakers (52-F5 to 52-F10)
- For auto-transformers C.B (52-AT1 & 52-AT2)
- For auto-transformers C.B (52-T1 & 52-T2)
- For bus coupler C.B (52-BC)

c) Contact resistance measurement

Tests for 220 kV Inductive Voltage Transformers

a) Preliminary checks & visual inspection
b) Insulation resistance tests
c) Ratio and polarity test
d) Voltage circuits in control, protection & metering panel

Tests for 220 kV Current Transformers

a) Preliminary checks & visual inspection
b) Hi-Pot & insulation resistance tests
c) Hi-Pot test
d) I.R. test of secondary windings
e) Ratio, polarity & wiring test by primary injection

Tests for 220 kV Disconnecting/Earth Switches

a) Preliminary checks before starting
b) Visual inspection of safety clearances/distances
c) Hi-Pot tests
d) Operation tests
   i) Manual opening & closing operation - verification
   ii) Close/open operation from local/remote position
   iii) Opening/closing test under maximum/minimum supply voltage
      - Under max. voltage
      - Under min. voltage
e) Auxiliary contacts commutation - verification
f) Additional tests for earthing switch

Draft

NATIONAL TRANSMISSION AND DISPATCH COMPANY
SPECIFICATION P-

GRID STATION LIGHTING
DESIGN DEPARTMENT (NTDC)

SPECIFICATION P-

FOREWORD

1) This standard specification has been prepared by the Design Department of NTDC/WAPDA
2) This specification is intended only for the purpose of procurement of material and does not include the provision of contract.

3) This specification is subject to revision as and when required.

4) In case the requirements laid down herein differ from those given in IEC publication in any particular, the lighting of control house building shall comply with the requirement listed herein.

1. GENERAL

The lightning system shall be such that all parts of a substation can be adequately illuminated All lights shall give good visual performance and shall be free from excessive glare, stroboscopic effects and flicker from discharge lamps. Safety and amenity shall be important considerations of the lighting design. The system shall be designed to ensure satisfactory operation and service life under all variations of voltage, frequency and temperature.
Outdoor lighting shall be switched from the gate or relay/control room respectively by main switch and by photocell automatically.
For indoor lighting, main fluorescent lamps to be used and switches shall be used for maximum four fluorescent lamps. Rooms with more than four light fittings shall be operated by impulse current relays. An impulse switch shall be provided at each door. All lighting switches shall have illuminating LED's for easy location in the dark.

2. INDOOR LIGHTING

Levels of illumination for particular areas shall be designed to the following values, and shall be generally in accordance with CIBS (U.K) Code for Interior Lighting.
Average Illumination

Control and Relay Room office	350 lux (min)
Mosaic Control Board in Control Room	450 lux (min)

These values apply to the vertical face of cabinets and kiosks and shall have a uniformity factor based on the minimum/average Luminance of not less than 0.7 measured on a horizontal line 1.5m above floor level.

Average Luminance

- Switchgear Hall 250 lux (min)

In GIS switchgear halls the light sources shall be wall mounted and easily accessible for maintenance, Top of GIS equipment shall be illuminated by floodlights on walls/ceiling.

Average Luminance

Battery Room, Ventilation Plant Room, and Diesel Generator Plant Room. Fire Water Pump Room, NGR Room Store	250 lux (min)
Workshop	350 lux (min)
Cable Basement	150 lux (min)

These values shall be measured at floor level except for the workshop where measurements shall be taken on a horizontal plane 0.7m above floor level. A uniformity factor of not less than 0.7 shall apply.

Average Luminance

- Corridors Stairways, Entrance Halls, Toilets 200 lux

This value shall be measured at floor level and have a uniformity factor of 0.5 min All luminaries shall comply with BS 4533.

3. OUTDOOR LIGHTING

The levels of illumination shall be designed to the values indicated hereunder.

- Transformer and Reactor Bays. Average luminance 300 lux
- Outdoor Switchyard 30 lux

4. LIGHTING SWITCHES

4.1 Lighting switches shall generally be metal-clad 15 amp. “AC only” type capable of operating at their full rated capacity.

4.2 Switches shall one way, two way or intermediate as required and where mounted together they shall be fitted in a common box. For surface installations they shall be fitted with fixed grids and in flush installations the girds shall be adjustable.

4.3 Switches mounted externally shall be of weatherproof pattern fitted with machined box and cover joint, brass operating handles, neoprene weather light seals and external fixing feet.

4.4 Switches controlling battery room lighting shall e mounted outside the room adjacent to the access door Sockets.

4.5 3 phase and 1 Phase switched sockets are to be provided at relay/control room switchgear hall, basement and at outdoor substation area. Outdoor socket shall be of weatherproof and dust proof type. The Purchase/Engineer will decide location and number of socket outlets.

4.6 125 Amp. Triple pole and neutral switched socket shall be provided near each transformer for oil treatment. These sockets shall be weatherproof design and suitable for outdoor installation. These switched sockets shall be supplied from
A.C. distribution panel.

4.7 Emergency lighting shall permit survey in the operating rooms, in the relay/control room, outdoor switchyard area etc. These emergency lights shall be positioned to the approval of the Purchaser/Engineer.

4.8 The lighting distribution board shall be of cubicle type sheet metal enclosed and free standing or wall mounted type. The distribution board shall be of front access only, dead front design and be furnished with hinged door and lock. The distribution board shall be sized to house all future circuits for expansion. Each distribution board shall be furnished with the necessary circuit breaker for incomer supply and with miniature circuit breaker for outgoing feeders. In addition 20% spare outgoing feeders of each capacity shall be provided over and above the present and future extension requirement. All spare feeders shall be complete in all respect and shall be wired upto the terminal block.

5 EMERGENCY LIGHTING

5.1 Emergency lighting shall comply with BS 5266 where not in conflict with the Specification, and shall be operated at 110V DC. It shall provide sufficient illumination not less than 10 lux in all areas to ensure the safe movement of personnel, safe access to and exit from any part of the substation.

5.2 On failure of the AC supply the emergency lighting shall be automatically illuminated from the 110V DC supply. The control system shall be such that the emergency lighting is switched off after 10 minutes, unless over-ridden. At the end of the 10 minute period, an indicating lamp shall be illuminated. An over-ride switch shall be provided to extend the period of operation, either during the initial 10 minute period or subsequently. A sensitive voltage relay shall be provided to monitor the battery voltage, set to operate when the voltage falls to a value corresponding to a remaining battery capacity of the normal standby load for the remainder of the discharge period plus the emergency lights for ten minutes, plus the instantaneous charge requirement, as set out in the Clause on Batteries in the Section of AUXILIARY POWER SUPPLIES. On operation of the voltage relay, a warning buzzer shall be sounded, and after a 10 minute delay, the emergency lights shall be extinguished, and shall remain so until the battery voltage has recovered. If the AC supply returns

during the period of operation of the emergency lighting then the latter shall be switched off and re-set automatically.

5.3 Self-contained illuminated "Exit" signs complying with BS 5499 shall be provided in each room over the doors of emergency escape routes. These units shall provide sustained lighting of the legend and of the door threshold with AC supply is present and for a minimum of 1 hour after its failure.

5.4 Test facilities shall be provided for checking that the emergency lighting system is in working order.

5.5 Portable rechargeable emergency lights shall be provided one each in switchgear halls, relay room, sprinkler room and entrance areas.

All wiring for the emergency lighting system shall be mineral insulated copper-sheathed cable (MICC) or locally manufactured Flame retardant 750 C for 3 hours as per IEC.

6. SECURITY LIGHTING SYSTEM

Security lighting on periphery wall and on the building shall be provided in accordance with the Security and Safety Directive SSD-13, Security Lighting Systems and as directed by the Engineer.

7. TESTS

7.1 **Sample Tests**

1) **Sample Tests on conductor**

i) Elongation Test
ii) Electrical Resistance Test

2) **Sample Test on Insulation and Sheath**

(i) Tensile Strength Test.
(ii) Aging Tests
(iii) Heat Shock Test
(iv) Heat Distortion Test
(v) Cold Bend Test (for insulation only)
(vi) Elongation Test (for sheath only)
(vii) Resistance to Burning Test
(viii) Measurement of thickness of insulation & sheath
(ix) Accelerated water absorption test (for insulation outer)
(x) Color Fastness Test. S

3) **Routine Tests**

(i) High Voltage
(ii) High Voltage D.C. Tests

8. DRAWINGS AND INFORMATION

The following drawings and information shall be submitted to the Engineer for approval.

(a) Physical layout of equipment in indoor lighting scheme. Flush mounted fittings shall be shown integral with the ceiling the arrangement.

(b) Physical layout of equipment in outdoor lighting scheme.

(c) Physical layout of equipment in emergency lighting scheme.

(d) Electrical schematic diagrams of all lighting schemes showing operation and control.

(e) A description of the lighting schemes involved and their operation and control.

(f) Equipment schedule to over all items of equipment and giving complete information on each item including manufacture, type rating etc.

Before putting into service and taking over by the Employer, detailed instructions on operation and maintenance shall be submitted to the Engineer.

8.1 Color Fastness Test

1) Color Fastness to Water

A piece of core about 100mm long, from which the conductor has been removed (or a piece of sheath about 100mm long, from which the core
have been removed) shall be cut into small pieces and then immersed in about 10 times its own volume of distilled water for 48 hour at a temperature of 70 C. At the end of this period the water shall be examined.

2) Color Fastness to Day Light

This test shall be made in accordance with method 507 A, in BS 2782:
part 5.

8.2 Voltage Tests

These tests shall be made on each entire length of completed cable.

1) Alternating Current Voltage Test

This test shall be made with alternating potential from a transformer and generator of ample capacity but, in no case, less than 5 kilovolt-amperes. The frequency of the test voltage shall be normally, between 25 and 60 hertz and shall have a wave shape approximating a sine wave as closely as possible.

2) Direct Current Voltage Test

This test shall be made after the insulation resistance test described in clause 8.3 of this specification.

3) Application of Test Voltage

The voltage shall be applied between the conductor or conductors and the water in which the cables have been immersed for at least 6 hours. In addition, each conductor of multiple-conductor cable shall be tested against all other conductors.
The initially applied alternating current test voltage shall be not greater than the rated alternating current voltage of the cable under test and initially applied direct current voltage shall be not greater than 3.0 times the rated alternating current voltage of the
cable. In all cases, the rate of increase from the initially applied voltage to the specified test voltages in clauses 7.10 & 7.11 shall be approximately uniform and shall not be over 100 percent in 10 seconds not less than 100 percent in 60 seconds.
The duration of the alternating current voltage test shall be 5 minutes. The duration of the direct current voltage, test shall also be 4 minutes.

8.3 Insulation Resistance Test.

The insulation resistance shall be measured after the completed cable alternating current voltage tests. Where the voltage tests are made on wire or cable immersed in water, the insulation resistance shall be measured while the cable is still immersed. Single conductor cables shall be tested between the conductor and water. Multiple conductor cables shall be tested between each conductor and all other conductors and water. The conductor under test shall be connected
to the negative terminal of the test equipment and reading shall be taken after an electrification of 1 minute.

8.4 Measurement of Thickness of Sheath

The test shall be made in accordance with IEC-227:67 clause 12.

8.5 Accelerated Aging Test

The test shall be made in accordance with with IEC 330:70 clause 4.

8.6 Heat Distortion Test

This test shall be made in accordance with IEC-330:70 clause 8.

8.7 Elongation Test

This test shall be made in accordance with IEC-330:70 clause 7.3.

8.8 Heat Shock Test

This test shall be made in accordance with IEC-330:70 clause 6.

8.9 Resistance to Burning Test

This test shall be made in accordance with IEC-227:67.

9. TEST SAMPLES, ACCEPTANCE AND REJECTION

a. The manufacturer shall offer to the inspector all necessary test facilities and assistance for carrying out the tests. The facilities shall be provided free of charge.

b. The manufacturer shall divide each consignment into lots for inspection. These lots shall be so selected that material in a lot is of reasonably uniform quality and as far as possible is manufactured at the same time and under the same conditions. The manufacturer shall keep sufficient production records to ensure that this can be done regularly. A lot may contain any no of lengths upto max of 15.

c. From each lot, regardless of its size, samples of cables shall be take4n at random from four length of cable. One sample sufficient to provide the required no of specimens for each test, shall be taken from each cable, single core or multicore, in each of the selected lengths.

d. The samples taken shall be subjected each of the tests prescribed in clause 7.The lot shall be accepted, if for each test, the sample complies with the requirements of the test.

e. If any test, at the most one specimen fails the sample shall be considered acceptable for the test.

f. If two specimens fail in any test, a further sample shall be take4n from the lot, and the particular test repeated. If there are no further failures the sample be considered acceptable for the test.

g. If in any test three or more specimens fail, the entire lot shall be rejected.

10 PACKING AND MARKING

Control cables shall be supplied on standard wooden reels. The reels shall be made from high quality wood and shall be of sound construction, able to withstand the usual rigours of transportation and field construction. The wooden reels shall be given two bursh coats of pentachlorophenol solution in oil before winding of cable. The cable shall be wound tightly.

The complete periphery of single core cable reel shall be protected by one mm thick paper and that of the multi core cable reel shall be protected by heavy wooden hagging nailed at each end of the reel flanges shall also be bound by two steel straps.

The manufacturer shall provide the following marking on the reels in legible and indelible letters.

i) Manufacturer’s name and designation

ii) Address of the consignee and purchase order number.

iii) Serial number of reel.

The manufacturer shall stamp the following information on metallic plates which shall be securely nailed to the reel.

i) Size and designation of control cables e.g. 2.5 mm. 16 core, 600/1000 V etc.
ii) Weight (net gross)
iii) Total length of control cables on the reel, in meters.

Both sides of the reel shall have an arrow mark indicating the direction of rolling. All markings shall appear on both sides of the reel.

DRAFT

SPECIFICATION P-

EARTHING AND LIGHTNING PROTECTION

DESIGN DEPARTMENT (NTDC)

1

EARTHING AND LIGHTNING PROTECTION

CONTENTS

SECTION NO. TITLE

1. GENERAL

An earthing system generally in accordance with the requirements of IEEE 80 and BS 7430 should be designed under this contract for each new site and for new works at existing sites. Installation and the supply of all materials and equipment should also be included. The earthing system should include earth electrodes to provide the connection to the general body of the earth and all conductors and connections to all electrical equipment and metallic structures on the site. The earth electrodes should limit the potential rise under fault conditions and buried conductors should be provided to limit potential differences on the site and adjacent to the site to ensure safety to people and animals.
For design purpose the resistivity of concrete and interlocking tiles should be taken as 3000
□–m.

Protection against lightning should also be provided.

The earthing and lightning protection system for any new extension should be suitably connected to the existing system.

2. SOIL SURVERY

The preliminary tender design should be based on a value of earth resistivity which should be determined by the Tenderer.

The Contractor should carry out an earth resistivity survey on each site and report in writing to WAPDA/NTDC in accordance with the approved programme. The report should detail the methods and instruments used and the results of the surveys. Based on the results the contractor should include in the report his proposals for the resistivities to be used in the design of the eathing system.

The value of resistivities to be used in the design of the earthing system will be subjected to WAPDA/NTDC approval.

The surveys should show the variation of resistivity across the site and with the depth below the site. The contractor should consider if there is a need to model the resistivity in two layers and if there is any advantage in the use of long rod. The surveys should also determine the depth and nature of any underlying rock, which may limit the depth, for driving earth rods and, if boring is necessary, for installing earth rods.

The weather conditions prior to and at the time of the surveys should be recorded in the report and an assessment made of the seasonal variations in resistivity based on meteorological data for the area. The programme for the project should, as far as possible, time the resistivity surveys to take place during a dry season.

The report should also state if there are any indications that the ground is corrosive to bare copper or if there is any risk of Galvanic corrosion on other metal structures in the neighborhood.

The report will be approved by WAPDA/NTDC before proceeding with the design of the earthing system.

3. FAULT CURRENT AND DURATION

The earthing system design calculation by the contractor should be based on earth fault withstand current.

The estimated maximum duration of the fault current should not be less than 3.0 s for the 132 kV system, 5.0 s for 33 kV and for the 11 kV system.

The calculations should be submitted to WAPDA/NTDC for approval prior to commencing the design of the earthing systems.

4 EARTH ELECTRODE SYSTME DESIGN

4.1 Design Calculations

The design of the earth electrode systems should be based on the approved earth resistivity data and the systems fault currents and their duration.

The design calculations will be subjected to the approval of WAPDA/NTDC and they should be based on the methods given in the standards listed. The calculations should include the following parameters:-

(a) earth resistance of the whole system of its components
(b) earth potential rise
(c) step, touch and mesh potentials inside and outside the perimeter fence
(d) requirements for a high resistance surface layer
(e) conductor ratings

Step, touch and mesh potentials will be within the limits calculated in accordance with the standards given in IEEE 80 and BS 7430 for the proposed surface layer. The formula for allowable body current should be used for 50 kg body weight.

4.2 Earth Electrode

The earth electrodes should comprise a system of bare conductors forming a mesh buried near the surface of the ground supplemented, if required, by one or more of the following electrodes:-

(a) a system of interconnected rods driven into the ground
(b) a system of bare conductors buried in the ground
(c) structural metalwork in direct contact with the ground
(d) reinforcing steel in buried concrete
(e) a system of bare conductors buried near the surface of the ground outside the perimeter fence

4.3 Mesh System

The mesh system should be designed in accordance with sub-clause “Design calculations” above to limit touch, step and mesh potentials taking into account the combined length of the mesh conductors, other buried conductors and rods but excluding any buried conductors outside the perimeter fence. Due regard should be given to non-linear distribution of the fault current giving rise to the highest potentials at mesh corners.

The rating of the mesh conductors should be compatible with the fault currents after allowing for parallel paths with a minimum conductor size of 300 mm^2 copper.

The current division factors = 0.8 of given fault current should be taken for design calculations of ground mesh.
If the placement of earthing mesh is designed for outside of the building, the depth of mesh should be 2 meter below the ground level or this should be atleast 1 meter below the power cables of standard depth.

4.4 Interconnected Rods

If the design calculations show that a mesh alone is unable to limit the potentials to the required values, then the mesh should be supplemented by the use of interconnected earthing rods driven into the ground or installed in bored holes.
Rods should be installed inside the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. (The spacing between rods should not be less than their length, unless rating considerations determine otherwise). The rods should be interconnected in groups of four to ten rods by yellow-green coloured PVC insulated stranded copper conductors to form a ring. Each group should be connected to the mesh by duplicate insulated copper conductor via disconnecting test links.

Individual rods may be connected directly to the mesh provided the conductor to the rod can be disconnected for testing the rod.

Rods installed in bored holes may be used to reach lower resistivity ground strata at depths beyond the reach of driven rods or where rock is encountered and it is not possible to drive rods. After installing the rod the bored hole should be back-filled with a low resistivity liquid mixture which should not shrink after pouring to ensure good contact between the rod and the ground for the life of the installation.

The resistance and rating of individual rods and the combined resistance of the groups of rods in the proposed design should be calculated and the rating of the interconnecting conductors should not be less than that of the main grid conductor.

The calculation of potentials in the design of the complete installation should be made without the group of rods with the lowest estimated resistance to simulate the condition with the group disconnected for testing.

4.5 Other Conductors

As an alternative to rods to supplement a mesh, additional bare copper conductors with a cross-section area of not less than 300 sqmm could be used. They should be buried in the ground within the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. Such conductors may be laid below the mesh, below foundations or in areas where there is no plant. It should be shown by calculation that the step potentials are low in such areas.
Interconnecting conductor size for connections to earth electrode, transformer neutral, lightning arrester, Gas Insulated switchgear/panels should be same as main grid conductor.

The conductor should be placed in a ring or a part of a ring with at least two widely separated connections to the mesh or other parts of the earthing system.

4.6 Reinforcing Steel

The reinforcing steel in the foundations of buildings containing the primary electrical equipment may be used as auxiliary electrodes subject to the approval of WAPDA/NTDC. The contractor should show in the design calculations that the fault currents and d.c. Stray currents will not damage the structure.

Steel reinforcing mesh in the floors of the building may also be used for the control of step and touch potentials within the building subject to the approval of WAPDA/NTDC.

4.7 Conductors Outside Perimeter Fence

If the design calculations show that the step and touch potentials outside the perimeter fence, gate or wall exceed the limits then additional bare conductors should be buried in the ground outside the fence in the form of rings encircling the whole site.

The distance of the conductors from the fence and the depth should be determined in the design to ensure that step and touch potentials are within the limits.
The minimum conductor size should be 70 sq mm and should be connected to the fence or the mesh with 70 sq mm conductors at each corner of the site and at intervals of not more than 100m. These conductors should not be included in the calculations called for above.

4.8 Gas Insulated Switchgear

The earthing of gas-insulated switchgear (GIS) installations will be subjected to special considerations regarding step and touch potentials in accordance with the standards listed. However, the earthing conductor should be yellow-green coloured PVC insulated stranded copper conductor of minimum overall conductor size of 300 sq mm. The connection should be at multiple points.

5. DESIGN OF EARTH SYSTEM

5.1 Earth System

An earth system should comprise the following components:-

(a) the conductors between the earth electrode system and the main earth bar
(b) the main earth bar
(c) the conductors between the main earth bar and the metallic frames, enclosures or supports of electrical equipment
(d) the conductors between structural metal work and non-electrical equipment and the main earth bar

The rating of earth system conductors connected between an item of electrical plant and the earth electrode system should be sufficient to withstand the fault currents and duration, after allowing for the parallel paths through the earth system conductors, which any one conductor disconnected.

The design of earth system should take into account the corrosiveness of the soil based on the soil survey.

5.2 Main Earth Bar

The main earth bar should be in the form of a ring or rings of bare conductors surrounding or within an area in which items to be earthed are located. Where two or more rings are installed they should be interconnected by at least two conductors which should be widely separated.

The main earth bar or parts thereof may also form part of the earth electrode system provided it is a bare conductor.

Each main earth bar should be connected by at least two widely separated conductors to the earth electrode system.

The minimum conductor size for the main earth, and, interconnections between earth bars and the earth electrode system should not be less than 300 sq mm copper.

5.3 Connections to Electrical Equipment

Connections between HV electrical equipment and the main earth bar, and the connections between LV electrical equipment (which comprises of substantial multi-cubicle switchboards) and the main earth bar should be duplicated. The minimum conductor size should be 300 sq mm and it should be yellow-green coloured PVC insulated stranded copper conductor.

Connections between other LV electrical equipment and the earth bar need not be duplicated. The single conductor should be rated to withstand the fault rating of the equipment. The conductor size should not be less than 185 sq mm and should be yellow-green coloured PVC insulated stranded copper conductor.

An earth mat should be installed at all operating positions for outdoor HV equipment manual operating mechanism boxes and local electrical control cubicles to ensure the safety of the operator. The mat should be directly bonded to the cubicle and the conductors forming the mat. The bonding connection should have a copper cross-section area of 185 sq mm or equivalent.

5.4 Connections to Structural Metalwork and Non-Electrical Equipment

All metalwork within the project area which does not form part of the electrical equipment should be bonded to the main earth bar except where otherwise specified .The bonding conductor size should not be less than 185 sq mm.

Individual components of metallic structures of plant should be bonded to adjacent components to form an electrically continuous metallic path to the bonding conductor. Small electrically isolated metallic components mounted on non-conducting building fabric need not be bonded to the main earth bar.

6 MATERIALS AND INSTALLATION

6.1 Conductors

Conductors should be of high conductivity copper in the form of circular conductors stranded to IEC. 228 (BS 6360) or solid rods or bars to BS.1433.

Conductor sheaths should be of yellow-green coloured PVC to meet the requirements of BS.6746 Grade TM1 or IEC 502 Grade ST1 with a minimum thickness of 1.5 mm.

Buried conductors which are not part of the earth electrode system should be PVC sheathed circular stranded cable.

Bare strip conductors only should be used for earth electrodes or voltage control meshes.

Conductors buried in the ground should normally be laid at a depth of 1000 mm below the underground power cables in an excavated trench. The backfill in the vicinity of the conductor should be free of stones and the whole backfill should be well consolidated. Conductors not forming part of a voltage control mesh should be laid at the depth required by the approved design and, in the case of a yellow-green colour PVC sheathed conductor, at the same depth as any auxiliary power or control cables following the same route.
All conductors not buried in the ground should be straightened immediately prior to installation and supported clear of the adjacent surface.

6.2 Earth Rods

The earth rods should be of hard-drawn high conductivity copper with a diameter of not less than 15mm with hardend steel driving caps and tips. The rods should be as long as possible but couplings may be used to obtain the overall depth of driving required by the design.

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

If difficult driving conditions arising from hard or rocky ground are encountered or are anticipated or there is a need for deep rods, then high tensile steel rods should be used. High tensile steel rods should have a molecularly bonded high conductivity copper coating with a minimum radial thickness of not less than 0.25 mm. The overall diameter should not be less than 15mm.Rolled external screw threads should be used on the rods for coupling and after rolling the thickness of the copper coating on the threaded portion the thickness should not be less than 0.05 mm.

Rods, driving caps and tips should abut at couplings to ensure that the couplings and screw threads are not subjected to driving forces. All screw threads should be fully shrouded at the couplings. Alternatively, conical couplings may be used to the approval of WAPDA/NTDC.

High conductivity copper for earth rods should have a minimum copper content (including silver) or 99.90% to ISO1337, Cu-ETP or Cu-FRHS (BS 2894 Grade C101 or C102) for copper earth rods and to ISO 1337 Grade CU-ETP (BS 28734 Grade C101) for the molecular bonded copper coating of steel rods.

The steel for copper-clad steel rods should be low carbon steel with a tensile strength of not less than 570 N/mm2 to ISO 630, Grade Fe 430A (BS 4360,Grade 43A) or better.

Couplings for copper rods should be of 5% phosphor bronze (copper-tin-phosphorous) to ISO 427, CU Sn4 (BS 2874, Grade PB 102M and for copper bonded steel rods of 3% silicon or 7% aluminum bronze to (BS 2874, Grade CS 101) and BS 2871, Grade CA 102.

6.3 Fittings

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

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

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

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

Sheathed conductor support fittings may be of silicon aluminum, glass-filled nylon or other tough non-hygroscopic material for indoor installations.

Fittings not in direct contact with bare or sheathed conductors may be of hot dipped galvanized steel.
Bi-metallic connectors should be used between conductors of dissimilar materials and insulating material should be interposed between metallic fittings and structures of dissimilar materials to prevent corrosion.

6.4 Joints

Permanent joints should be made by brazing, exothermic welding or by crimping.

Detachable joints should be bolted and stranded conductors at bolted joints should be terminated in exothermically welded lugs or a crimped cable socket. The diameter of any holes drilled in strip conductors should not be greater than half the width of the strip.
Connections to electrical equipment should be detachable and made at the earthing studs or bolts provided on the equipment by the manufacturer. When an earthing point is not provided the point and method of connection should be agreed upon with WAPDA/NTDC.

Connection to metallic structures for earthing conductors and bonding conductors between electrically separate parts of a structure should be either by direct exothermic welding or by bolting using a stud welded to the structure. Drilling of a structural member for a directly bolted connection should only be carried out to the approval of WAPDA/NTDC.
Bolted joints in metallic structures including pipe work, which do not provide direct metallic contact should be bridged by a bonding conductor or both sides of the joint should be separately bonded to earth unless the joint is intended to be an insulated joints for cathodic protection or other purposes.

When the reinforcing in concrete is used as a part of the earthing system the fittings used to provide a connection point at the surface of the concrete should be exothermically welded to a reinforcing bar. This fitting should be provided with a bolted connection for an earthing conductor. The main bars in the reinforcing should be welded together at intervals to ensure electrical continuity throughout the reinforcing.
No connections should be made to reinforcing bars and other steelwork, which do not form part of the earthing system and are completely encased in concrete.

6.5 Measurement of Earth Resistance

The resistance of the complete earth system should be measured before installation of outgoing cables by the contractor and with OHL termination towards disconnected from the earth mat with an approved form of earth resistance tester. The measured value should be submitted for approval and should not exceed 0.125□ when measured between the earth system and the surrounding earth.

On completion of the earth mat system, the step and touch potentials should be measured in accordance with the "Tests on Completion".

7 EARTHING OF FENCES

7.1 Method

Metallic fences should be separately earthed unless they come within 1.8m of any equipment or structure above the surface of the ground, which is connected, to the main earthing system. If the separation of 1.8m cannot be obtained the fence should be bonded to the earthing system.

7.2 Separately Earthed Fences

The earthing of a fence should be provided by connecting certain metallic fence posts to an earth rod by a copper conductor. The earth rod should be driven adjacent to the posts inside the fence line to a depth of not less than 3.0m. Where no metallic posts are provided, the earth rods should be connected directly to the metal wires, mesh, or other components of the fence.

If owing to the nature of the ground it is not possible to drive earth rods, then fence posts should be connected to the centre point of a 20 m length of bare copper conductor buried in the ground at a depth of 1000 mm running parallel to and close to, the inside of the fence or below the depth of power cables.

The earth rods or bare conductor electrodes should be installed at each corner post, below the outer phase conductors of overhead line connections, passing over the fence at each gate and at intervals of not more than 100 m.

7.3 Bonded Fences

Fences which need to be bonded to the main earthing system of the installation should be connected by copper conductors to the nearest accessible point on the main earthing system at each point where the fence accessible point on the main earthing system at each point where the fence comes within 1.8 m of any electrical equipment. Bonds should also be made to each corner post, below the outer phase conductors of overhead line connections passing over the fence, at each gate and at intervals of not more than 100 m.

7.4 Bonding Fence Component

Fences made up of bolted steel or other metallic components do not require bonding between components. Where such fences have non-metallic components bonds should be installed to maintain continuity between metallic components. Reinforced concrete components should be treated as being non-metallic.

Longitudinal wires for supporting other fence components or for anti-climbing guards and the wires of chain link should be directly bonded to each fence earth electrode or to each bond to the main earthing system.

Metallic components on masonry, brick, concrete or similar boundary wall should be treated in the same manner as metallic fences.

Wire fence components coated for anti-corrosion protection or PVC coated fence should be earthed in accordance with this clause.

7.5 Gates

The fixed metallic components on both sides of the gate should be directly bonded together by a copper conductor installed under the surface of the access way. Flexible conductors should be installed to bond the moving parts of the gates to the metallic fixed parts. An earth rod or a bond to the main earthing system should be installed at each gate.

7.6 Potential Control Outside Fences

Where the approved design calculations show that the touch or step potentials outside the fence or boundary wall would otherwise be excessive, bare copper conductors should be buried in the ground outside the fence or boundary wall at such depths and spacings as are shown in the approved design calculations to give acceptable touch and step potentials. The conductors should form complete rings surrounding the installation and each ring should be bonded to the adjacent ring and to the fence at each corner. Below the outer phase conductors of overhead line connections passing over the fence, at each gate and at intervals of not more than 100 m. In this case separate earth electrodes are not required for the fences.

If the boundary fence or wall is substantially non-metallic the rings of conductors should be bonded to the main earth system at each corner of the site an at intervals of not more than 100m. Any metallic components on such boundary fences or walls should be bonded to the earthing system in accordance with this specification.
If the boundary fence is metallic and is not within 1.8 m of any part of the main earthing system or equipment bonded thereto the fence and outer conductor rings should not be connected to the main earthing system unless the approved design calculations show otherwise.

Any meshes formed by bonding the outer conductors to the main earthing system should be sub-divided by additional conductors, if required, to give acceptable touch, step an mesh potentials.

7.7 Conductors

All conductors used for earthing and bonding the fences and components and for outer rings should have a cross-sectional area of not less than 185 mm2 copper.

8. LIGHTNING PROTECTION

Overhead earth wires supported from switchgear structures or overhead line towers within the area of the installation should be bonded to the earthing system at each

structure or tower. The metalwork of the structure, including steel reinforcement in concrete, may form part of the bonding conductor in accordance with BS 6651.

Lightning protection should be provided on all new buildings.

The designs, installation, and materials for the lightning protection systems should be in accordance with BS. 6651 and this specification. The lightning protection system may be inter-connected with the earthing system provided the conductors form the most direct path for lightning currents from the air terminals to the earth electrodes. Additional conductors and earth electrodes should be installed as necessary to ensure a direct path.

The protection angle should be taken as 30□ from the vertical plane. The adequacy of lightning protection should be attained by installing air terminals and suspended shield wires over the buildings & equipments.

The down leads should be brought in such a manner that they pose minimum risk to the personnel and do not disturb the beauty of the building/installation.

9. CATHODIC PROTECTION

The contractor should study the soil characteristics if anodic corrosion is a matter of concern in the substation location and accordingly provide cathodic protection if required.

Similarly, the adverse effect of connecting the reinforcement to the earth grid should be studied. The study report on this respect should be submitted.

10. LIST OF STANDARDS

ANSI/IEEE/std 80	IEEE Guide for safety in AC Substation Grounding
ANSI/IEEE/std 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potential of a Grounding system
BS 7430	Code of Practice for Earthing
DIN VDE 0141	Earthing System for Power Installations with Rated Voltages above 1 kV
BS 6651	Protection of Structures against Lightning
BS 1432	Specification for copper for electrical purposes: high conductivity copper rectangular conductors withdrawn or rolled edges.
BS 1433	Specification for copper for electrical purposes. Rod and bars
BS 2871	Specification for copper and copper alloys
BS 2874:	Specification for copper and copper alloy rods and sections (other than forging stock).
BS 4360:	Specification for weldable structural steel
BS 6360:	Specification for conductors in insulated cables and cords
BS 6746:	Specification for PVC insulation and sheath of electric cables.
ISO 427	Wrought copper-tin alloys – chemical composition and form of wrought productions
ISO 428	Wrought copper – aluminum alloys – chemical composition and forms of wrought productions
ISO 1187	Special wrought copper alloys – chemical composition and forms of wrought products.
ISO 1337	Wrought coppers (having minimum copper contents of 99.85%) – chemical composition and forms of wrought products
ISO 630	Structural steels
IEC 502	Extruded solid dielectric insulated power cables for rated

	voltages from 1 kV to 30 kV.
CCITT	Directives concerning the protection of telecommunications lines against harmful effects from electricity lines.
BS 7361	Cathodic Protection part-1 code of practice for land and marine applications.

DRAFT

SPECIFICATION P-

HVAC AND FIRE EXTINGUISHERS

PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY DESIGN DEPARTMENT (NTDC)

HVAC AND FIRE EXTINGUISHERS

1 GENERAL

1.1 Scope of Work

The Contractor shall furnish all labour, materials, equipment tools, appurtenances, services, temporary work and storage necessary to completely supply, install, test, commission and maintain, heating, ventilation and air condition (HVAC) system and fire extinguishing system all in perfect operating condition in accordance with these Specifications and Drawings. The Contractor shall commission, operate and maintain all the system for a period specified elsewhere in the Contract Documents.

These specifications are only general guidelines and by no means cover details of each equipment. These only spell out the intent of the requirement. The details have to be provided by the Contractor along with details of performance, construction and technical literature. The specifications are to be read in conjunction with Drawings.

All equipment and materials shall be brand new bearing stamped ratings as required and must be approved by the Engineer prior to their use.

2. HVAC SYSTEM

The Contractor shall design, supply, install and commission the HVAC system in control room, relay testing laboratory, office, relay room and PLC room. The Contractor shall install ventilation in battery room, 11 kV switchgear room, switchgear rooms, workshop and store. The Contractor shall design the HVAC system with 50 percent standby capacity for the satisfactory operation of the equipment.

2.1 Related Works

The Contractor shall provide all works related as necessary for satisfactory operation of HVAC system whether specifically mentioned or not. These related works shall include, but not be limited to:

a) **Electrical Works**

Power supply shall be made available at junction boxes with isolating device adjacent to each ceiling mounted AC unit and upto ACP (Apparatus Control Panel) with 1200 mm loose termination. All electrical work including power and control wiring from these points onward shall be the responsibility of the Contractor.

b) All works related to cooling coil condensate disposal from A/C units upto nearest floor drains shall be the responsibility of the Contractor.

The size and slope of condensate pipe shall be subject to Engineer’s approval

c) Cutting of wall/slab openings, patching and repairing in accordance with Specifications.

d) All wood-work required for satisfactory completion of the project as specified except decorative wood work provided to conceal HVAC equipment.

e) All Concrete Pads and foundations for HVAC equipment

f) Removal of glass panes to install piping, or other HVAC equipment/ material and re-fixing/chipboard and/or masonry work, plaster and paint to seal airtight the penetration, where required.

2.2 Work also Included

Work listed hereunder, which may be required for satisfactory completion of the Project, is included in this Contract.

a) Decorative concealment of HVAC equipment and wooden paneling.

b) Boxing of pipes

c) Protective fencing around HVAC equipment, if required

There shall be no additional payment for above purpose and Contractor to include these in unit rates of other items.

2.3 Units

The units used in these specifications are as under:

Unit System: **S.I.**

TR: Ton of Refrigeration Equivalent to 3519 Watts

2.4 Design Conditions

HVAC System has been designed with conditions listed hereunder. These conditions are being given for the information of the contractor to enable him to perform specified tests under these conditions

2.4.1 Outside Design Conditions

a) Summer Dry Bulb Temp. 43.3 C Wet Bulb Temp: 28.3 C

b) Latitude: 32 Degrees North

2.4.2 Inside Design Conditions

a) Dry Bulb Temp: 25 C

b) Relative Humidity: 50(+/-)5%

2.5 Equipment Submittals, Information Manuals, Samples And Contractor's Other Submissions

2.5.1 Manufacturer's Data

Manufacturer's performance data, certified factory drawings and/or curves of apparatus giving full information as to capacity, performance at different operating and ambient conditions, dimensions, materials electrical data and all information pertinent to the adequacy of the submitted equipment shall be submitted for approval.

2.5.2 Samples

Contractor shall provide at his cost, samples of materials, instruments, gauges and electrical items, for approval by the Engineer at Engineer's Head Office at Lahore before order is placed for the same, these samples shall include but not limited to:

i) Pipes and Fittings

ii) Pipe insulation, and covering

iii) Power Control Cables and other electrical items including electrical conduits

iv) Insulation, tapes, caulking material

v) Adhesives

vi) Anchor bolts, studs etc.

vii) Any other item required by the Engineer

2.6 Approval of Materials and Equipment

As soon as practicable after award of Contract, the Contractor shall submit for the approval of the Engineer specifications, drawings, catalogue – cuts, diagrams and other descriptive data for all materials, components and equipment which the Contractor proposes for use under this Contract alongwith Schedule of work with expected completion dates for each step. For certain material and equipment, data may be required to be submitted in accordance with a detailed form furnished by the Engineer. Items submitted shall be proper labeled to include the Contract number, project, manufacturer, source of supply, Contract Item number, and other data required by the Specifications. All items shall be submitted in sufficient time to permit proper consideration and action thereon without delaying the construction schedule.

2.7 Nameplates

The Contractor shall provide and attach to each major piece of equipment, a metal name and rating plate to be approved by the Engineer, giving the name and address of the manufacturer, the date and rating data. All rating shall be in the units as adopted for the project. Large lettering on any of the parts will not be permitted.

2.8 Maintenance Period

The Contractor shall service and maintain complete HVAC system for the duration of the defect liability period and shall include supply of operating staff, all necessary adjustments, filter cleaning and the furnishing of necessary tools, instruments supplies and parts to keep the system in perfect operation. All costs incidental to above specified Servicing and Maintenance shall be deemed to be included in the Contract Price. The Contractor shall also ensure that no one other than his own authorised personnel service/maintain the AC system during the Maintenance Period.

2.9 Inspection and Tests

2.9.1 Inspection by Engineer

The Engineer shall inspect the works in progress as and when considered necessary by the Engineer and the Contractor shall provide full access and assistance to the Engineer of carrying out inspection to verify the conformity of works to general layout of HVAC system as designed and as shown on Drawings and as specified. Such inspection if made shall not relieve the Contractor from any obligations under the Contract.

2.9.2 Tests

a) **General**

i) All tests as specified shall be carried out by the Contractor's workmen. The Engineer may instruct the Contractor to repeat some or all tests to verify the test results submitted to the Engineer.

ii) The Contractor shall given the Engineer at least seven days notice in writing of the data on which any equipment will be ready for testing as provided in the Specifications and the Contractor may proceed with the tests and shall forthwith forward to the Engineer five duly certified copies of test readings, on the forms approved by the Engineer.

iii) The Contractor shall provide all labour, materials, apparatus, machines and instruments as may be necessary to carry out tests.

iv) The cost of all tests under this Clause shall be borne by the Contractor if such tests are intended by or provided for in the Specifications

v) As and when HVAC system or part thereof shall have passed any test the Engineer shall furnish to the Contractor a certificate in writing to that effect upon submission of the written request by the Contractor.

vi) The Engineer may reject any part or parts of Equipment, and HVAC system which he shall after testing decide is not performing in accordance with the Specifications and Drawings and he shall give to the Contractor within fourteen days of such testing, notice in writing of such rejection starting therein the grounds upon which his decision is based.

The Contractor in the forms approved by the Engineer shall fill out the results. Copy of filled out forms shall be submitted to the Engineer for review and approval.

b) **Preliminary Tests**

Preliminary Tests shall be carried out on all HVAC system as the Engineer may require, on completion of installation of that equipment or at such time, which the Engineer may require.

c) **Pre-Start and Commissioning Tests**

Pre-start and Commissioning Tests shall be carried out on all HVAC system when the HVAC system as a whole is ready for operation.

d) **Performance Tests**

These tests shall be carried out after successful completion of Commissioning Tests, during appropriate season. Performance Tests may be carried out during Maintenance Period.

2.10 Materials

All materials shall be of the highest grade, free from defects and imperfections, of recent manufacture and unused, and of the classification and grades designated, conforming to the requirements of the latest issue of the appropriate specifications cited herein. All materials, supplies, and articles forming part of major equipment and nor fabricated by the manufacturer of the equipment shall be the products of the recognized reputed manufacturers.

2.11 Workmanship

Workmanship and general finish shall be of the highest grade in accordance with the requirements specified herein, and the best modern standard practice.

2.12 Equipment

a) Where the requirement of this Clause makes any equipment proprietary or non-obtainable, the Engineer reserves the right to waive any portion or portions of it.

b) When a manufacturer’s product is specified by name, or equivalent, it shall be in the sole judgment of the Engineer as to acceptability of any product, which is offered as equal to that specified.

c) Where two or more units of the same class of equipment are furnished, product of the same manufacturer shall be used, component parts of entire system need not be product of same manufacturer.

2.13 Chases and Openings

The Contractor shall provide templates or details for chases and openings to be left in Concrete walls and Concrete floors, to accommodate work under HVAC scope of work.

2.14 Protection

The Contractor shall keep pipe, and other openings closed to prevent entry of foreign matter. All fixtures, equipment and apparatus shall be covered and protected against dirt, water, chemical or mechanical damage, before and during the construction period. All fixtures, apparatus or equipment damaged including damaged shop coats or paint prior to Final Acceptance. All bright finished shafts bearings housings and similar items shall be protected unit in service: no rust will be permitted.

All outdoor equipment shall be protected against rust, corrosion.

2.15 Cutting, Patching and Repairing

Required for proper installation and completion of HVAC works and when included in Scope of Work as described, including masonry work, concrete work, carpentry work, painting and re-painting shall be performed by skilled craftsmen in respective trades, at the expense of the Contractor. Construction shall be cut only after obtaining written permission from the Engineer.

2.16 Lines and Levels

The Contractor shall check dimensions at the building site and establish lines and level for work specified in Specifications. The Contractor shall check with work of other trades to ensure proper clearance of piping, conduit and other items.

2.17 Sealing Of Openings

The Contractor shall seal all openings in external walls & roof, where HVAC pipers/Equipment penetrates in external membrane. The seal shall be air tight to prevent entry of contaminated outside air into the building. The method & materials for sealing shall be subject to Engineer's approval.

2.18 Air Conditioners, Piping & Electrical Works

2.18.1 Split Air Conditioners

Air conditioners shall be split type remote air cooled condenser, factory assembled tested, cooling units & shall include (buyt not limited to) cooling coil, fan casing, compressor, refrigerant controls & sepecialities. The gas charging shall be including in the cost of Air Conditioners.

2.18.2 Piping & Insulation

The Contractor shall provide all the drain piping from the drip pans or air conditioners to an acceptable discharge points. Insulation tape shall be wrapped around the pipe with 50% overlap & than covered with canvas soaked in approved bituminous compound.

The Contractor shall provide refrigerant piping of copper tubing. The diameter of pipe shall be as per recommendations of manufacturer of air conditioning units. Pre-formed sectional insulation shall be placed around pipe & insulation tape applied over the joint. Canvas soaked in approved bituminous compound , for outdoor application, & in approved insulation adhesive for indoor application, shall be wrapped on the insulation.

2.18.3 Electrical Works

(i) The Contractor shall provide apparatus control panel of sufficient size & dimensions in control room at Ist floor to the satisfaction of the engineer.

This panel with lock & key will contain the following equipment (but not limited to) :

- One incoming circuit breaker (MCCB)
- Bus bar, 3 phase plus neutral
- Outgoing MCCB one for each AC unit

- One voltmeter with 6 positions selector switch
- One ammeter on each outgoing line
- 3 signal lamps on incoming line
- 1 signal lamp on each outgoing line
- Plastic engraved labels
- Panel pre-wired and with earthing terminals.

(ii) The Contractor shall provide necessary cabling of sufficient size complete in all respects and ready for operation.

(iii) All cables to run in. PVC conduits except conduits expose to weather, which shall be G.I.

(iv) Isolator switch in metal box, one for each condensing unit.

3. FIRE EXTINGUISHERS

3.1 GENERAL

The Contractor shall also supply fire extinguishers for control room, relay room, PLC room, 11k V room & other associated buildings.

All portable & mobile fire extinguishers shall be simple in operation & handling, such that any person is able to operate them according to the printed instructions.

The fire extinguishers shall meet the following minimum requirements.

(i) Protection Against Corrosion

All part of the extinguishers shall be corrosion resistant. If the extinguishers are not constructed of corrosion-resistant material, they shall be suitable protected internally against attack by extinguishing & actuating media. The extinguishers shall be protected externally against normal atmospheric influence, & from short period attack by the extinguishing & actuating media.

(ii) Protection Against Over-Pressure

Suitable safety devices shall be provided on the equipment to protect against over-pressure. The portable fire extinguishers shall be fitted with spring loaded, interchangeable safety valves.

The valves shall be so designed that the pressure inside the container cannot rise above 90% of the test pressure of the container.

(iii) Reliability

With normal maintenance, the extinguishers must not become incapable of operation as a result of corrosion & chemical reaction owing to the atmosphere or due to other reasons.

(iv) Painting

The extinguishers shall be finish-painted in red colour.

(v) Marking

The name of manufacturer, type of media, test pressure, empty weight, fill-up quantity & filling pressure, shall be indicated on external surface of extinguisher at a suitable location.

Diagrammatic explanation of operation shall be given on each equipment & the year of manufacture firmly imprinted on each extinguisher.

All markings shall be distinct & easily visible.

(vi) Installation Of Equipment

The extinguishers shall be installed on the walls at convenient heights as per normal practice in industrial buildings. The extinguishers shall be installed in such a way that no damage is caused to the civil works. Any damage caused to the Civil Works shall be made good by the Manufacturer without any additional costs.

The clamps, brackets, & fixtures of the extinguishers shall be supplied & be such that the extinguishers can be simply & conveniently fixed & removed without loss of time.

3.2 MOBILE CO_2 GAS EXTINGUISHING CART

The mobile Co_2 extinguishing cart shall consist of one steel bottle containing 30kg of Co_2. the Co_2 steel cylinder shall be mounted on wheels with solid rubber tyres & shall be designed such that it can be moved freely by a single person. The operation of the extinguisher shall be simple such that it is put into operation by just detaching the snow pipe & opening the cylinder valve. The cylinder screw-valve shall enable the flow to be interrupted during operation.

Nozzle shall have stainless steel parts to ensure operation in all climates & atmosphere.

The entire wheeled extinguisher will be of welded steel construction & have protective coating to prevent corrosion.

All extinguishers shall be fitted with corrosion resistant nameplates.

All extinguishers under this specification shall be identical to ensure complete interchangeability.

The cart shall be equipped with a bottom plate to keep the extinguisher upright.

Couplings shall be constructed of material with strength & resistance to corrosion cracking.

House shall be approximately 15mm I.D. X 6m long & constructed of material, which retains flexibility.

3.3 Descriptive Data & Drawings

The Contractor shall submit complete details for the portable & mobile fire extinguishers in the form of technical literature, brochures, catalogues, etc., to show that all equipment & accessories which he would supply are of a standard make & are compatible with the laid down specifications. All the relevant drawings & calculations shall be submitted to the Engineer for approval.
Equipment, material & articles installed or used without such approval shall be at the risk of Contractor.

NATIONAL TRANSMISSION & DESPATCH COMPANY
Office of Chief Engineer (Design & Standards) NTDC
48-L Model Town Extension, Lahore.
Ph No.042/99230024, Fax No.042/99230025
Email: cedengg@yahoo.com.

No. 2100-2118/CEDS/Z-8. Dated: 07-06-2010

The Chief Executive Officers
All DISCOs.

Subject: **AMENDMENT NO.2 DATED 07.06.2010 – DDS-8:2007**

Enclosed please find herewith a copy of amendment no.2 of WAPDA specification DDS-8:2007 for your reference and record.

DA/As above.

MANAGER (D&S)
o/o Chief Engineer (D&S) NTDC 7/6/10

CC: -

- General Manager (Services Division) NTDC, PEPCO, Wapda House , Lahore.
- Chief Engineer (Material Inspection) NTDC PEPCO, Sunny View, Lahore.
- Director HV&SC Testing Lab. NTDC Faisalabad
- All cable manufacturers.

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SPECIFICATION NO. DDS-8:2007

SHEATHED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

AMENDMENT NO. 2

DATED 7TH JUNE, 2010.

Change the values in Sub Clause 4.3.1 Table-II, 1 (b)

"Shaped Conductor" (Minimum No. of strands) be read follow:

10mm²	25mm²	70mm²	120mm²	185mm²	300mm²
-	6	12	15	30	30

(NASIR OSMAN) Dy. Manager (D&S)	(MANSOOR NASIR) Manager (D&S)	(MUHAMMAD SHAFQAT) Chief Engineer (Design & Standards)

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NATIONAL TRANSMISSION & DESPATCH COMPANY
Office of Chief Engineer (Design & Standards) NTDC
48-L Model Town Extension, Lahore.
Ph No.042/99230024, Fax No.99230025
Email: cedengg@yahoo.com.

No. 408-24 /CEDS/Z-8 Dated: 29-01-2010

The Chief Executive Officers
All DISCOs

Subject: SHEATED INSULATED DISTRIBUTION CABLES 600 VOLTS (SID CABLES) - AMENDMENT NO.1

Enclosed please find herewith copy of Amendment No.1 of Specification No.8:2007 (Sheated Insulated Distribution Cables) for your guidance and record.

D A/Attached

29/1/2010
(AZIZ-UR-RHEMAN)
MANAGER (D&S)
O/O Chief Engineer (D & S) NTDC

c.c.to

- General Manager (C &M) (S.D) Power, WAPDA House, Lahore.
- Chief Engineer (MI) NTDC Sunny View, Lahore.
- All manufacturers of Sheated Insulated Distribution Cables

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SPECIFICATION NO. DDS-8:2007

SHEATED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

AMENDMENT NO.1

DATED 26th January 2010

Clause 12.3.3 is added as under:

12.3.3. Wrapping Test:

Out of all finished length, 1 % lengths of cables randomly selected shall be subjected to the wrapping test.

12.3.3.1 Procedure:
The aluminium wire shall be wrapped round a mandrel of diameter equal to the wire diameter to form a close helix of eight turns. Six turns shall then be unwrapped and again closely wrapped.
The wire shall not break or show any cracks.

26/1/10 (JAVAID NASEEB MALIK) DY. MANAGER (D&S)	26/1/2010 (AZIZ UR REHMAN) MANAGER (D&S)	29/1/2010 (MUHAMMAD SHAFQAT) CHIEF ENGINEER (D & S) NTDC

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PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY
Office of the Chief Engineer (Design & Standards) WAPDA
17/C-I, Ist. Floor, IEEEP Building, Faisal Town, Lahore
Ph.# 042/9231641 – Fax # 042/9231646
Email: cedengg@yahoo.com.

No. 4078-96/CEDS/Z-8 Dated: 17-10-2007

The Chief Executive Officer
All DISCOs

Subject: WAPDA SPECIFICATION NO.DDS-8:2007 – SHEATHED INSULATED DISTRIUTION CABLES

Enclosed please find herewith copy of revised WAPDA Specification NO.DDS-8:2007 – Sheathed Insulated Distribution Cables for your guidance and record.

17/x/07
(AZIZ UR REHMAN)
DIRECTOR (D&S)

Cc to:-

- General Manager (C&M) Power WAPDA WAPDA House, Lahore
- Chief Engineer (Material Inspection) WAPDA, Sunny View, Lahore.
- Chief Engineer (P&D) WAPDA, Lahore
- All manufacturers.

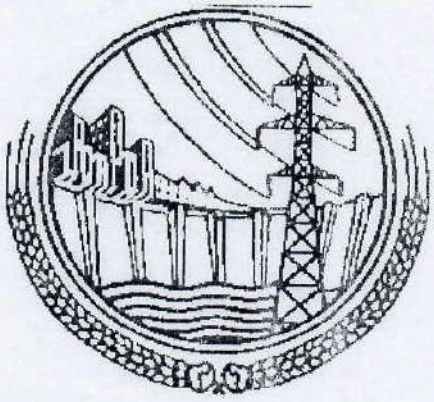
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY

WAPDA SPECIFICATION

DDS-8:2007

SHEATHED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)



OFFICE OF CHIEF ENGINEER (DESIGN & STANDARDS)
WAPDA, FAISAL TOWN, LAHORE

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CONTENTS

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SPECIFICATION NO. DDS-8: 2007

SHEATHED INSULATED DISTRIBUTION CABLES

600 VOLTS (SID CABLES)

0. FOREWORD

0.1 This Specification has been prepared by the Standards Directorate of Design Distribution Department.

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

0.3 This Specification is subject to revision as and when required.

0.4 This Specification super cedes product description PD-25,26a,27a; 28b & 29 and DDS-8:84.

1. SCOPE

1.1 This Specification covers single core, single core underground, two core, four core armoured and four core unarmoured cables for use in 415/240 Volts distribution system. It covers the sizes which have been standardized for use in WAPDA. This Specification covers the. cables, which will be commonly known as "SID Cables".

2. SERVICE CONDITIONS

2.1 The cable shall be suitable for operation in a 415/240 volts, 50Hz. three phase multiple neutral earthed distribution system.

2.2 The single core underground and four core armored cable shall be suitable for direct burial, rest of the cables shall be suitable for installation in air or running in the ducts. The duct and soil conditions vary from dry to wet. Highly corrosive salts are encountered in the soil.

2.3 Ambient Temperature:

Maximum.	50 °C
Max: mean over 24 hours.	45 °C
Mean in the year.	39 °C
Minimum.	-10 °C

2.4 Relative humidity may range upto 100%.

2.5 The cables shall be suitable for conductor operating temperature as follows :-

Continuous operation.	70 °C
Short circuit(5 sec. maximum duration)	160 °C.

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3. TYPES AND SIZES OF CABLES

3.1 The types and sizes of cables which have been standardized are given in Table-I:-

TABLE - I

Sr.No.	Type of Cable	Size of cable (mm^2)
1.	Single core cable.	25, 70, 120, 185, 300
2.	Single core underground cable.	25,70,120, 185, 300
* 3.	Two core cable.	10, ,25
**4.	Four core unarmoured cable	10, 25,70,120,185, 300
5.	Four core armoured cable	10,25, 70,120,185, 300

* 2 core 25mm^2 cable has also been standardized under twisted Unsheathed Distribution Cables.

** Four core 25, 70 & 95mm^2 cables have also been standardized under twisted Unsheathed Distribution Cables to be used in the narrow and zig zag streets of Cities and Villages as main and sub main distribution lines. Specified in DDS-1-85

4. CABLE CONSTRUCTION

4.1 Single .Core Cable (unarmoured)

4.1.1 The conductor shall consist of circular stranded aluminium of electrical grade purity as specified in IEC 228:78.

4.1.2 The insulation shall be extruded polyvinyl chloride compound over the conductor. The polyvinyl chloride compound shall have properties as given in clause 8 of this Specification and shall be suitable for continuous conductor temperature of 70 °C.

4.2 Single Core Underground Cable (Armoured)

4.2.1 The conductor shall be as given in clause 4.1.1.

4.2.2 The insulation shall be extruded polyvinyl chloride compound over the conductor. An extruded polyvinyl chloride compound sheath shall be applied over the insulation. General purpose PVC shall be used both for insulation as well as sheath and shall be suitable for continuous conductor temperature of 70 °C.

4.3 Two Core Cable

4.3.1 The construction of individual cores of the two core cable shall be the same as single core cable.

TABLE-II

Sr. No	ITEM	Nominal Cross-Sectional Area of Conductor					
		10mm²	25mm²	70mm²	120mm²	185mm²	300mm²
1	Conductor (i)Stranding (Minumim No of strands/ nominal dia of each strand,mm)						
	a)Circular conductor (non compacted)	7/1.35	7/2.14	19/2.14	37/2.03	37/2.52	61/2.52
	b)Shaped conductor (No. of strands)	-	7	19	37	37	61
	(ii) Weight of Conductor Kg / Km	27.7	69.5	189	331	509	839
2	Max Conductor D.C. resistant at 20deg C (ohm/km) for single core and multi core cables	3.08	1.2	0.443	0.253	0.164	0.1
3	Nimonal insulation thickness for:						
	a) Single core cable (mm)	-	1.5	1.98	2.3	2.3	2.74
	b) Multi core cable (mm)	1.2	1.42	1.64	1.86	2.3	2.74
4	Nimonal thickness outer sheath						
	a) Single core underground	-	1.4	1.6	2.05	1.97	2.74
	b) Two core	1.8	1.8	-	-	-	-
	c) Four core un armouorred cable	2.1	2.1	2.6	3.2	2.96	3.4
	d) Four core armouorred cable	2.08	2.1	2.52	3.08	3.147	3.51
5	Nominal thickness (mm) of bedding for four core armoured cable	1.64	1.8	2.36	2.61	2.7	2.87
6	Dia of armoured wire (mm) for four core armoured Cable only	1.6	1.6	2.1	2.64	2.5	3.175

Note:
The above values genrally conform to the values given in IEC standards , but some of values have been modiefied due to extream weather condations of Pakistan

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4.3.2. The core shall be laid flat and sheathed with a black PVC compound.

4.4 Four core Unarmoured Cable

4.4.1 The individual core of cable below 25mm sq. shall be of circular stranded cross-section while those 25mm sq. and above may either be of circular cross section or shaped cross section. The shaped cross section cable shall conform to IEC-228:78.

4.4.2 Circular Stranded Cross-Section Cables

4.4.2.1 The four individual cores shall be laid up together with a right hand lay. A right hand lay is defined as clock-wise twist away from the observer.

4.4.2.2 The laid up cores shall have PVC/Polypropylene fillers both at the centre and the outer sides to give the cable a round shape. Thickness of the sheath over the cores shall be according to Table-II of this Specification.

4.4.2.3 Polypropylene binding tap having a thickness of 35 micron and above shall be wrapped over the laid up cores and fillers with a fifty percent overlap.

4.4.2.4 The polypropylene fillers twin are of suitable tex having a softening point not less than 150°C.

4.4.3 Shaped Stranded Cross-Section Cables

4.4.3.1 The laid up shall have PVC/Polypropylene fillers both at the centre and the outer sides to give the cable a round shape.

4.4.3.2 Polypropylene binding tap having a thickness of 35 micron and above shall be wrapped over the laid up cores and fillers with a fifty percent overlap.

4.4.3.3 Polyproperlyne binding tap shall have the property of splitting longitudinally but no lattitudinally.

4.4.3.4 The PVC shall be applied over the cores having the thickness as per Table-II.

4.5 Four Core Armoured Cable

4.5.1 The construction of the four core armoured cable shall be the same as of four core unarmoured cable with the exception that a single layer of galvanized steel wire shall be applied over the extruded PVC bedding. The direction of armour wire shall be left handed. A PVC sheath shall be applied over the armour wire, thickness of PVC sheath shall be as per Table-II.

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5. **CORE IDENTIFICATION**

5.1 The cores of all cables shall be identified by colours in accordance with following sequence:-

Sr. No.	Type	Colour
1.	Single Core cable	Black
2.	Two Core cable	Red, Black
3.	Four Core cable	Red, Black, Light Blue and either Yellow or Green

6. **DIMEN SIONS**

6.1 The dimension of conductors shall be in accordance with Table-I. The cross-sectional. area of conductor shall be the sum of the areas of its component wires. The stranding of conductor shall be as given in Table-II.

6.2 For 2-Core,10mm sq,Cables

6.2.1 The tolerance /Nominal values mentioned in this specification be so adjusted that the overall size of 2-core,10 mm sq cable should remain within the following limits:-

(a) Width Wise — 15.0 mm (Minimum) 16.5 mm (Maximum)

(b) Depth/Height wise — 9.2 mm (Minimum) 10.1mm (Maximum)

6.2.2 There should be no gap between insulation and sheath.

7. **CONDUCTOR**

7.1 The conductor shall be 3/4th hard drawn stranded aluminum conforming to IEC 228:1978.

7.2 For circular conductor, the successive layers shall have opposite direction of lay, the outer most layer being right handed. The wires in each layer shall be evenly and closely stranded.

7.3 For sector shaped conductor only nominal areas and maximum D.C. resistance are to be checked.

7.4 Tolerance

7.4.1 ±1% tolerance is allowed on diameters of individual strands of circular conductors only. This tolerance is not applicable for sector shaped conductors.

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8. POLYVINYL CHLORIDE FOR INSULATION AND SHEATH

8.1 The insulation and sheath shall be made from polyvinyl chloride compound type 'A' conforming to IEC 502:78 and shall be suitable for service conditions described in clause. 2 of this specification. The polyvinyl compound shall meet the following properties

8.2 Original Physical Properties

a) Minimum tensile strength	12.5 N/mm^2 OR 1.27kg/mm^2
b) Minimum elongation at break	150 percent.

8,3 Properties After Ageing in Air Oven

Ageing Conditions	
Temperature.	80±20 °C
Duration of treatment.	168 hours.
a) Tensile strength after ageing, percentage of unaged value.	Max 120 Min. 80
b) Elongation at break after ageing, percentage of unaged value.	Max: 120 Min. 80

8.4 Heat Shock Test

Test conditions :

Temperature.	150± 2 °C
Duration of treatment.	1 hour
Result obtained.	No cracks

8.5.. Heat Distortion

Temperature	80±2 °C
Time under load.	First case 4 hours (for cables up to conductor size of 35mm sq.) Second case 6 hours (for cables having conductor size more than 35mm sq.)
Maximum percentage distortion	50%.

8.6 Cold Bend Test

Test conditions::	
Temperature .	- 15±2 °C
Result to be obtained	No cracks

8.7 Resistance to Burning

Self extinguishing.

8.8 Colour Fastness

The colour of insulation and sheath shall fast to both, water and to sun light.

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9. **INSULATION**

9.1 The insulation shall be made of polyvinyl chloride compound described in clause 8. The nominal insulation thickness shall be according to Table-II.

9.2 Tolerance

9.2.1 The insulation thickness given in Table-II are based on rated voltages.

9.2.2 The average thickness of the insulation shall not be less than the specified nominal value.

9.2.3 Thickness at any place may however be less than the specified nominal value provided the difference does not exceed 0.1mm + 10% of the specified nominal value.

10 **SHEATH**

10.1 The sheath shall be made of polyvinyl chloride compound described in clause 8 of this specification. The nominal sheath thickness shall be in accordance with Table-II.

10.2 Tolerances

10.2.1 The average thickness of the sheath shall not be less than the specified nominal values.

10.2.2 The thickness at any place may however be less than the specified nominal value provided the difference does not exceed 0.lmm + 10% of the specified nominal value.

11. **ARMOURING**

11.1 Bedding (Inner covering & Filler)

11.1.1 The bedding for four core armoured cable shall consist of an extruded Layer of PVC, general purpose PVC Shall be used. Nominal thickness of bedding shall be as given in Table-II. The PVC for the bedding shall meet the requirements laid down in clause 8 of this specification.

11.1.2 The average thickness of bedding shall not be less than the specified nominal values.

11.1.3 The thickness at any place may however be less than the specified nominal value provided the difference does not exceed 0.lmm + 10% of specified nominal value.

11.2 Wire Armour

11.2.1 Wire armour shall consist of a single layer of galvanized steel wires and the nominal diameters of round armour wire shall be as given in Table-II. The direction of lay of armour shall be left hand. The armour wire shall have following properties :-

a) The wire shall be of good uniform quality of circular cross-section free from splinters, irregularities and brittle places, and capable of being welded.
b) The tensile strength shall not be less than 37.8 kg/ mm ^{2} and not more than 50. kg/mm^2.
c) The elongation at break shall not be less than 12 percent.
d) The dimensions of armour wires shall not fall below the nominal values by more than 5%.

12. TESTS

12.1 Electrical Sample Tests for PVC insulation & Sheath

12.1.1 The PVC insulation and sheath shall be subjected to following tests:
i. Insulation resistance measurement at room temperature.
ii. Insulation resistance measurement at maximum rated temperature.
iii. High voltage alternating current test.

12.2 Non Electrical Sample Tests for PVC Insulation & Sheath

i. Measurement of thickness of insulation and sheath.
ii. Tests for determining the mechanical properties of insulation before and after ageing.
iii. Weight loss test.
iv. Heat distortion test.
v. Heat shock test.
vi. Test for the behaviour of PVC at low temperature. (cold bend test)
vii) Colour fastness test.
viii) Accelerated water absorption test.
ix) Resistance to burning.

12.3 Routine Test

12.3.1 Out of all finished lengths, 10% lengths of cables randomly selected shall be subject to the following tests:-

i) Conductor resistance test
ii) A.C. Voltage

12.3.2 The manufacturer shall maintain record of Routine Tests carried out during the manufacturing process, which may be seen by the Inspector while undertaking testing as described in clause 12.3.1 above.

13. TEST SAMPLES, ACCEPTANCE AND REJECTION

13.1 The manufacturer shall afford to the inspector all necessary test facilities and assistance for carrying out the tests. The facilities shall be provided free of charge.

13.2 The manufacturer shall divide each consignment into lots for inspection. These lots shall be so selected that material in a lot is of reasonably uniform quality and as far as possible is manufactured at the same time and under the same conditions. The manufacturer shall keep sufficient production records to ensure that this can be done regularly. The lot size shall consist of any number of lengths up to a maximum of as follows :-

i.	Single core/Two core cables	500 lengths.
ii.	Four core cables	100 lengths.

13.3 From each lot, regardless of its size, samples of cables shall be taken at random from the following lengths of cables: -

i. Single core/Two core cables 2 lengths.
However, if the samples so taken from the offered lots are less than 10 lengths then 10 lengths shall be subjected to the tests.

ii. Four core cables 2 lengths
However, if the samples so taken from the offered lots are less than 5 lengths then 5 lengths shall be subjected to the tests.

One sample sufficient to provide the required No. of specimens for each test, shall be taken from each cable, single core or multi-core, in each of the selected lengths.

13.4 The samples taken shall be subjected to each of the tests prescribed in clause 12.1 and 12.2. The lot shall be accepted, if for each test, the sample complies with the requirements of clause 13.5.

13.5 If in any test one sample fails, the whole of, the respective lot shall be rejected.

14. TEST METHODS

14.1 Electrical Sample Test for PVC Insulation & Sheaths

The cable shall be subjected to the following tests, applied successively on the same sample of cable, 10 m to 15 m in length. The test shall be limited to not more than 3 cores.

14.1.1 Insulation Resistance Measurement at Room Temperature

a) This test shall be made on the sample length before any other electrical test. All outer covering shall be removed and the core shall be immersed in water at room temperature at least 1 hour before the test. The measurement shall be made between conductor and water. The measurement may be confirmed at 20+1°C. The D.C test voltage shall be 300 V to 500 V, and shall be applied for a sufficient time to reach steady measurement, but for not less than 1 min.

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b) Calculations The volume resistivity and/or the insulation resistance constant shall be calculated from the insulation resistance by the formula given below-

$$f = \frac{2X\ \pi\ LR}{\log_e\ D/d}$$

Where :

f = Volume resistivity in ohm centimeters.
R= Measured insulation resistance in ohms.
L= Length of the cable in centimeters.
D= Outer diameter of the insulation in millimeters.
d = Inner diameter of the insulation in millimeters.

Also the "insulation resistance constant Ki" may be calculated, using the formula

$$K_i = \frac{LR \times 10^{-11}}{\log_{10}\ D/d} = 10 \times 0.367\ f \times 10^{-11}\ M\ \Omega\ Km$$

c) Requirements: The values calculated from the measurement shall not be less than those specified in Table-III given below:

TABLE - III

Electrical, Type Test Requirements

Designation of the insulating compounds	PVC
- Maximum rated conductor temperature (C°)	70
- Volume resistivity (Ω cm)	
- at 20°C	10^{13}
- at max: rated temperature (70 °C)	10^{10}
- Insulation resistance constant K_i	(M Ω Km)
- at 20°C	36.7
- at max: rated temperature (70°C)	0.037

14.1.2 Insulation Resistance Measurement at Maximum Rated Temperature

a) The core of the cable sample with all outer covering removed shall be immersed in water which shall be heated at the specified temperature for at least 1 hour before test. The D.C test voltage shall be 300 V to 500 V and shall be applied for a sufficient time to reach steady measurement, but not less than 1 min.

b) Calculations: The volume resistivity and/or the insulation resistance constant shall be calculated from the insulation resistance by the formula given in sub clause 14.1.1.b.

c) Requirements: The values calculated from the measurements shall not be less. than specified in Table-III given above in sub clause 14.1.1.c.

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14.1.3 High Voltage Alternating Current Test

a) Procedure: The cores of the cable sample with all outer coverings removed shall be immersed in water at room temperature for at least 1 hour.
A power frequency voltage equal, to three times the rated voltage shall be gradually applied and maintained continuously for 4 hours between the conductor and the water.

b) Requirements: No break down shall occur.

14.2 Non-Electrical sample Tests for Insulation & Sheaths

14.2.1 Measurement of Thickness of Insulation

a) Sampling : One sample of each cable core shall be taken from each of three places separated from each other by at least 1 m. For cables having more than three cores of equal nominal cross-section, the number of cores on which the measurement is made shall be limited to three cores or 10% of the cores, which ever is large

b) Procedure : The measurement shall be made as described in clause 4 of IEC Publication 540.

c) Requirements: The average, which shall be rounded off to the nearest 0.1 mm of all the measured values on each core shall not be less than the specified nominal thickness and the smallest measured value shall not fall below 90% of the specified nominal thickness by more than 0.1 mm.

14.2.2 Measurement of Thickness of Sheaths

a) Sampling: One sample of cable shall be taken from each of three places separated from each other by at least 1 m.

b) Procedure: The measurements shall be made described in clause 4 of. IEC Publication 540.

c) Requirements: Each piece of sheath shall comply with the following

The average, which shall be rounded off to the nearest 0.1 mm of the measured values shall not be less than the specified nominal thickness. The smallest value shall not fall below 90% of the specified nominal thickness by more than 0.1 mm.

14.2.3 Test for Determining the Mechanical Properties of Insulation Before and After Ageing

a) Sampling: Sampling and the preparation of the test pieces shall be carried out as described in clause 5 of IEC Publication 540.

b) Ageing Treatment: The ageing treatments shall be carried out as described in clause 6 of IEC Publication 540 under the condition specified in clause 8.3 of this specification.

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c) Conditioning & Mechanical Tests: Conditioning and the measurement of mechanical properties shall be carried out as described in clause 5 of IEC Publication 540.

d) Requirements: The test results for unaged and aged test pieces shall comply with the requirements given in clauses 8.2 and 8.3 of this specification.

14.2.4 Tests for Determining the Mechanical Properties of Sheaths Before and After Ageing

a) Sampling: Sampling and the preparation of the test pieces shall be carried out as described in clause 5 of IEC Publication 540.

b) Ageing Treatments: The ageing treatments shall be carried out as described in clause 6 of IEC Publication 540, under the conditions specified in clause 8.3 of this specification.

c) Conditioning and Mechanical Tests: Conditioning and measurements of mechanical properties shall be carried out as described in clause 5 of IEC Publication 540.

d) Requirements: The test results for unaged and aged test pieces shall comply with the requirements given in clauses 8.2 & 8.3 of this specification.

14.2.5 Additional Ageing Test on Pieces of Completed Cables

a) General: This test is intended to check that the insulation and sheath are not liable to deteriorate in operation due to contact with other components in the cable.
The test is applicable to the cables of all types.

b) Sampling; Samples shall be taken from the completed cable as described in clause 6 of IEC Publication 540.

c) Ageing Treatment: The ageing treatment of the pieces of cable shall be carried out in an air oven, as described in clause 6 of IEC Publication 540, under the following conditions:

Temperature:	10±2°C above the rated operating conductor temperature of the cable or, if the operating temperature of the cable is not known, 10±2°C above the rated operating conductor temperature for the insulating material.
Duration	168 hours.

d) Mechanical Tests: Test pieces of insulation and sheath from the aged pieces of cable shall be prepared and subjected to mechanical tests as described in clause 6 of IEC Publication 540.

e) Requirements: The variation between the medium values of tensile strength and elongation at break after ageing and the corresponding values obtained without ageing (See sub-clauses 14.2.3 and 14.2.4) shall not exceed the values applying to the test after ageing in an air oven specified in clause 8.3 of this specification.

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14.2.6 Weight Loss Test on PVC Insulation and Sheaths

a) Procedure: The sampling and complete test procedure shall be in accordance with clause 7 of IEC Publication 540.

b) Requirements: The test results shall comply with the following requirements:

Treatment:	80±2 °C
Max: possible loss of mass.	2 mg/cm^2

14.2.7 Test for the Behaviour of PVC Insulation and Sheaths at High Temperatures (Heat Distortion Test)

a) Procedure: The sampling and test procedure shall be in accordance with clause 8 of IEC Publication 540 employing the test conditions given in clause 8.5 of this specification.

b) Requirements: The test results shall comply with the requirements given in clause 8.5 of this specification.

14.2.8 Test for Behaviour of PVC Insulation and Sheath at Low Temperatures (Cold Bend Test)

a) Procedure: The sampling and test procedure shall be in accordance with clause 9 of IEC Publication 540, employing the test temperature specified in clause 8.6 of this specification.

b) Requirements: The results of the tests shall comply with the requirements given in clause 8.6 of this specification.

14.2.9 Test for Resistance of PVC Insulation and Sheaths to Cracking (Heat Shock Test)

a) Procedures The sampling and test procedure shall be in accordance with clause 10 of IEC Publication 540, the test temperature and period of heating being in accordance with clause 8.4 of this specification.

b) Requirements: The results of tests shall comply with the requirements given in clause 8.4 of this specification.

14.2.10 Colour Fastness Test for Sheaths & Insulation

14.2.10.1 Colour Fastness to Water

A piece of core about 100 mm long, from which the conductor has been removed (or a piece of sheath about 100 mm long, from which the cores have been removed) -shall be cut into small pieces and then immersed in, about 10 times its own volume, of distilled water for 48 hours at a temperature of 70°C. At the end of this period the water shall be examined. Requirement as per clause 8.9 of this specification.

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14.2.10.2 Colour Fastness to Day Light

14.2.10.2.1 The test will be considered as a sort of type test but will be carried out one in a purchase order.

14.2.10.2.2 This test shall be made in accordance with method 507 A, in BS 2782 : Part 5. Requirement as per clause 8.8 of this specification.

14.2.11 Accelerated Water Absorption Test

14.2.11.1 Gravimetric Method

14.2.11.1.1 Test Specimen

A 275 mm test specimen of the insulated conductor shall be taken if the weight of the specimen is less than 100 grams. For heavier specimens, a segment of the insulation 100mm long and 25mm wide shall be out from the insulated conductor and smoothed to remove all corrugations.

14.2.11.1.2 Preparation of Test Specimen

The surface of the test specimen shall be cleaned by scrubbing with a lintless cloth moistened with water. The specimen shall be dried for 48 hours at 70°C and then weight to the nearest milligram, weight, A. The area, S, shall be the number of square centimeter in a 254 mm length of the insulated wire or the total area in square centimeter of the segment. The insulated wire specimen shall be bent in the shape of a U around a mandrel having a diameter not less than three times in tightly fitting holes in the cover of a 1-point glass jar so that 254mm of the specimen will be immersed when the jar is completely filled with water and cover applied.

14.2.11.1.3 Immersion of Specimen

The test specimen shall be immersed in freshly boiled distilled water at 70°C for 168 hours. The level of the water shall be maintained flush with the under surface of the cover during the soaking period. The segment-shaped specimen shall be completely immersed. After the specimen has been immersed for 168 hours, the water shall be cooled to room temperature. The specimen shall he removed and the adhering water shaken off. The specimen shall be bolted lightly with lintless cloth and weighed within 3minutes to the nearest milligram, weight B. The specimen shall be dried in a vacuum of 5 millimeters of mercury or less over calcium chloride at 70°C for 48 hours and then weighed to the nearest milligram, weight C.

14.2.11.1.4 Calculation

The water absorption shall be calculated in terms of milligrams per square centimeter of surface as follows :

(if C is less than A) = B-C

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Water absorption (if C is greater than A) $= \frac{B-A}{S}$

Where:
A= Weight of the specimen in milligrams before immersion.
B= Weight of the specimen in milligrams after immersion.
C= Weight of the specimen in milligrams after drying in vacuum.
S= Total area in square centimeter of the test specimen.

14.2.11.1.5 Requirements:

Max: water absorption = 1.5 mg/cm^2

14.2.12 Resistance to Burning.

a) Procedure: Compliance is checked by the following test which is made on three samples of the completed flexible cable each 30 cm long. The test is made in still air with a Bunsen burner, having a nozzle, with an internal diameter of 9mm burning town gas. With the burner „in the vertical position, the flame is adjusted so that the over-all height of the flame is 10cm with an inner blue cone of 5 cm. The burner is then supported so that its axis is at an angle of 45 degree to the vertical. The sample is held vertically, in such a position that the tip of the inner cone of the flame touches the surface of the sample at a distance of approximately 10cm from its lower end. The sample is held in the flame for 1 minute. If the insulation or sheath burns, it shall do so slowly and the burning shall not spread-appreciably; any flame shall have died out in less than 30 seconds after removal of the burner.

b) Requirement: The insulation and sheath shall be self-extinguishing.

14.3 Routine Tests

The routine tests shall normally be carried out on all finished cable lengths. The routine tests required by this standard are:-

14.3.1 Measurement of Electrical Resistance of Conductor

a) Sampling: For multi core cables the measurement shall be made on all the conductors of each insulated conductor selected for the routine tests.

b) Procedure: The complete cable length, or a sample there from, shall be in the test room, which shall be maintained at reasonably constant temperature, for at least 12 hours before the test. If it is doubtful whether the conductor temperature is the same as the room temperature,. the resistance shall be measured after the cable has been in the test room for 24 hours. Alternatively, the

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15.4 For 5% of the 2 core cable length on order, 100 meters length i.e. one coil may be supplied in two workable random lengths neither of which shall be shorter than 40 meters. Such coil shall be clearly marked with the length of two pieces on wrapper, and the payment would be made for length actually supplied.

15.5 The single core and four core cables shall be whirled around the wooden drums. The length of the cable shall be as given in Table - IV

TABLE – IV

Sr. No.	CABLE	Length of cable on Drum
Single core cable		
i)	25,70 & 120mm ^{2}	1000 meters.
ii)	185 & 300 mm ^{2}	500 meters.
Four core unarmoured cable		
i)	10 mm ^{2}	250 meters.
ii)	25, 70 & 120 mm ^{2}	200 meters.
iii)	185 & 300 mm ^{2}	150 meters.
Four core armoured		
i)	10 mm ^{2}	250 meters.
ii)	25 & 70 mm ^{2}	200 meters
ii)	185 & 300 mm ^{2}	100 meters.

15.6 The dimension of the wooden drum will be as per drawing No. CEDE/DDST/18. The reels shall be made from high quality KIKER WOOD and shall be of sound construction, able to withstand the usual rigors of transportation and field construction. The complete periphery of the reels apart from being protected by heavy wooden lagging nailed at each end of the reel flanges as per Fig. CEDE/DDST/18 shall also be bound by two steel straps. The wooden reel shall be given two brush coats of 100% creosote before winding of cable.

15.7 The manufacturer shall provide the following markings on the reels/pickings in legible and indelible letters:

i) Manufacturer's name and designation.
ii) Cable designation.
iii) Address of the consignee and purchase order No.
iv) Sr. No. of the reel/packing

15.8 The manufacturer's shall stamp the following information on metallic plates which shall be securely nailed to the reel. In case of packing the following information shall be printed on card stapled securely to the packing:

i) Size and designation of the cable.
ii) Net weight, tare weight and gross weight in Kg.
iii) Total length of the cable on the reel/packing in meters
iv) Sr. No. of the reel/packing.

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resistance shall be measured on a sample of conductor contained for at least 1'hour in a temperature controlled oil bath. The measured value of resistance shall be corrected to a temperature of 20°C and 1 KM length in accordance with the formula and factors given in clause 6 of IEC-228:1978.

c) Requirements: The D.C resistance of each conductor at 20°C shall not exceed the appropriate maximum value specified in Table-II of this specification.

14.3.2 Alternating Current Voltage Test

The test shall be made at room temperature with an alternating voltage approximately of sine wave form having a frequency in the range 40 Hz. to 62 Hz. The value of voltage shall be 3000 volts.

a) For armoured cable the voltage shall be applied between each insulated conductor and all the other conductors and armour wires, which shall be earthed.

b) For unarmoured cable the voltage shall be applied between conductors.

c) For single core cable, it shall be immersed in water at room temperature for one hour and test voltage then be applied between the conductor and water. The test voltage shall be increased gradually and maintained at full value (3000 volts) for 5 minutes.

15. MARKING AND PACKING

3KV for min

15.1 The word "WAPDA" shall be super scribed on every meter length of all the cables in the form of protruding mould.

15.2 The two core cable shall be supplied in coils of 100 meters length wrapped in Hessian/Cotton cloth/Polyethylene. of the following characteristics :-

Hessian:

Thickness	0.8mm
Shearing Strength	1.00 to 1.04 kg/mm ^{2}

Cotton Cloth :

Thickness	0.40mm
Shearing Strength	2.2 to 2.6 kg/mm ^{2}

Polyethylene

Thickness	0.15mm
Shearing Strength	0.35 to 0.55 kg/mm ^{2}

The wrapping should be overlapped.

15.3 For two core cable a tolerance of ±5% in standard length of L.T. PVC cables is allowed for only 10% coils of the entire order.

15.9. **Both sides of the reel shall have an arrow mark indicating the direction of rolling.**

15.10 **All markings shall appear on both sides of the reel in the positions indicated in Fig.CEDD/DDST/18.**

15.11 **In case of packing the following information shall be printed on sticker paper pasted on steel sheet of size 9 x 6 cm tagged with the packing."**

i) Manufacturer's name and designation.
ii) Cable designation.
iii) Address of consignee with P.O. No.
iv) Total length of Cable.
v) Serial Number of the Coil.

16. **ENCLOSURES**

(NASIR OSMAN) Deputy Director (D&S)	20/7/07 (AZIZ UR REHMAN) Director (D&S)	(YAQOOB BAIG MIRZA) 8/9/2007 Chief Engineer (Design & Standards)

SOP FOR
BLACKLISTING OF CONTRACTORS

NATIONAL TRANSMISSION & DESPATCH CO. LTD

Company Secretary

No. NTDC/CS/ / *191-207* **Dated: 27 - 02- 2019**

NOTIFICATION

Approval for revision of SoP for Blacklisting

Ref: This office notification No.NTDC/CS/1728-42 dated 25.07.2017.

The Board of Directors National Transmission & Despatch Company Limited (NTDC) in its 150th meeting held on 25.02.2019 against agenda item No.10 has unanimously resolved and approved the revised/amended SoP for Blacklisting.

Ijaz Ahmad
Company Secretary

Copy to:

1. Managing Director.
2. Dy. Managing Director (AD&M).
3. Dy. Managing Director (P&E).
4. All General Managers.
5. Chief Financial Officer.
6. Chief Law Officer.
7. Chief Internal Auditor.
8. Chief Information System.

A copy of the revised SoP for Blacklisting is enclosed.

NATIONAL TRANSMISSION & DESPATCH CO. LTD

Company Secretary

No. NTDC/CS/ *444-60*

Dated: *29* - *0 3* - **2019**

CORRIGENDUM

Approval for revision of SoP for Blacklisting

In continuation to this office Notification No.NTDC/CS/191-207 dated 27.02.2019 on the subject matter, the designation of Chief Engineer (Reliability Assessment) being a committee member in Chapter No.3 under Clause 3.1 at page # 7 of the approved revised/amended SoP for Blacklisting may be read as 'Chief Engineer (Reliability Compliance)'.

Note:

- **All other contents of the notification will remain intact.**

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Company Secretary

Copy to:

1. Managing Director.
2. Dy. Managing Director (AD&M).
3. Dy. Managing Director (P&E).
4. All General Managers.
5. Chief Financial Officer.
6. Chief Law Officer.
7. Chief Internal Auditor.
8. Chief Information System.

NATIONAL TRANSMISSION AND DESPATCH COMPANY LIMITED (NTDC)

REVISED SOP FOR BLACKLISTING

(As on 25.02.2019)

Table of Contents

CHAPTER NO.1

1.1 INTRODUCTION

The main objectives of any procurement process are transparency, economy, fairness and efficiency so that value for money is achieved.

Blacklisting is one of the most effective tools used in the struggle against inefficiencies and corruption in connection with public procurement. In addition, it serves as a major deterrent against any material breach of contract and further ensures the timely execution of projects by holding delinquent persons accountable.

Rule-19 "Blacklisting of suppliers and contractors" of the Public Procurement Rules, 2004 (hereinafter "**PPRA Rules**") stipulates that;

"The procuring agencies shall specify a mechanism and manner to permanently or temporarily bar, from participating in their respective procurement proceedings, suppliers and contractors who either consistently fail to provide satisfactory performances or are found to be indulging in corrupt or fraudulent practices. Such barring action shall be duly publicized and communicated to the Authority:
Provided that any supplier or contractor who is to be blacklisted shall be accorded adequate opportunity of being heard."

In the light of the Clause above, this SOP has been drafted for procurements made by NTDC.

Any capitalised terms and abbreviations used in this SOP which are not defined herein shall have the meanings given to them in Public Procurement Regulatory Authority Ordinance, 2002 (hereinafter "**PPRA Ordinance**") and PPRA Rules.

1.2 EXTENT OF APPLICATION

i. The procedure shall be applicable and remain in force, along with any amendments thereto, within NTDC until any clear instructions or guidelines are imparted by the Government through PPRA, PEC, or any other competent forum.

ii. The procedure shall also be applicable on the pre-qualified firms.

iii. The procedure shall be applicable on any "Person", which for the purposes of this SOP shall *interalia* include suppliers, bidders, contractors, consultants, firms, individuals, and organizations transacting business with NTDC.

iv. Wherever any provision of this SOP shall be in conflict with provisions of any applicable guidelines of donor agencies, or any other applicable Statute / Law or Rule enforced at the time in Pakistan, the provisions of such applicable guidelines, laws, or rules shall prevail.

v. This SOP shall become a part of the future Bidding Documents and the person(s) will submit an Undertaking along-with his bid that he has read and accepts the provisions of this SOP. Non-submission of an Undertaking may result in rejection of his bid. The said Undertaking will subsequently become part of the Contract Agreement as well.

CHAPTER NO. 2

2. REASONS OF BLACKLISTING

2.1 The causes and reasons to be taken into consideration for Debarment / Blacklisting of any person are given as under:

2.1.1 Pre- Award Stage:

The following shall be considered, *interalia*, the causes / reasons for initiating proceedings under this SOP at the Pre-Award Stage:

i. Indulging in Corrupt, Fraudulent as well as Collusive practices.

ii. Submission of false and spurious documents, making false statements, making frivolous complaints and allegations to gain undue advantage.

iii. Commission of embezzlement, criminal breach of trust, theft, cheating, forgery, bribery, falsification or destruction of records, receiving stolen property, false use of trademark, securing fraudulent registration, giving false evidence, furnishing of false information of serious nature.

iv. Submission of false bid security or infringement of documents to get undue monetary or any other benefit.

v. Breach of confidentiality of evaluation process as mentioned in Appendix- 1 based on illegal access or in any way to get undue benefit or to provide benefit or to frustrate the bidding/evaluation process. This will also include attempts to sabotage the bidding process directly or indirectly.

2.1.2 Post- Award Stage:

The following shall be considered, *interalia,* the causes / reasons for initiating proceedings under this SOP at the Post-Award Stage:-

i. Extraordinary delay in signing or refusal to accept the Notification of Award and/or the contract without any cogent reason.

ii. Misconduct, i.e., failure to proceed with the signed contract, withdrawal of commitments, quoting an unreasonably and unfairly low financial offer and subsequently withdrawing such an offer, frustrating the evaluation/bidding process and not responding to written communication in a reasonable time.

iii. Causes mentioned in Clause 2.1.1 (i, ii & iii) above.

iv. Submission of fake / frivolous or mutilated Performance Guarantee or Advance Payment Guarantee etc.

v. Non-satisfactory performance as mentioned in Appendix-2 during the execution of the contract.

vi. Non-performance or Breach of provisions / clauses of the contract agreements.

vii. Notwithstanding the warranty/defect liability period, any defect in a product, equipment, plant, facility or services rendered that may subsequently surface during field operations within 5 years of its commissioning.

viii. Failure to honour obligations within warranty period or defect liability period as defined in the contract.

2.1.3 Other Causes

i. The person is blacklisted by any Government department in Pakistan, or it is established that the firm is involved in any kind of corruption or corrupt practices anywhere in the world.

ii. Violations of provisions / instructions set down in the Bidding Documents.

iii. Any attempt / activity to malign or bring NTDC into disrepute and harm its interest(s).

iv. Person(s) blacklisted by International Financial Institutions (donor agencies) will be liable to be blacklisted after receipt of confirmation from the donor agencies without any further proceeding.

v. Any other cause deemed just and appropriate by NTDC in the given circumstances.

Note:

(1) If above mentioned causes occur either on part of the principal bidder or the local agent, both shall be considered for blacklisting / debarment.

(2) The authorization of the foreign bidder to local agent shall contain his complete particulars including the name of the company, name of the owner, National Tax number (NTN), CNIC (Computerized National Identity Card) No. etc. In case, the said information is found to be missing, even after calling for the same within a reasonable time, the authority letter shall not be accepted.

(3) The Bidding Documents shall be issued against original authority letter or in case of scanned copy, the email of the foreign bidder shall be enclosed. However, at the time of bidding, the original authority letter shall be attached with the bid. In the absence of the same, the bid shall be rejected.

CHAPTER NO. 3

3. FORMULATION OF "NTDC'S RIGHTS PROTECTION COMMITTEE"

3.1 A permanent Committee namely "NTDC's Rights Protection Committee (**RPC or Committee**)" comprising of the following members shall examine the justification of the reasons given by the Project Authority prior to blacklisting / debarment of any firm/supplier/contractor/ individual.

- General Manager (Performance Assessment) NTDC — Convener
- Chief Engineer (Reliability Compliance) NTDC — Member
- Representative of the Chief Law Officer's Office — Member

Depending upon the nature of the case, the Committee may consult or appoint / nominate additional members from within NTDC with the approval of Managing Director (NTDC), provided that the Committee consists of an odd number of individuals as per spirit of Rule 48(1) of the PPRA Rules. Independence of any additional members shall be ensured while making the selection of such additional members. Furthermore, the aforementioned RPC shall also be authorized to seek external expert advice as and when required.

CHAPTER NO. 4

4.1 PROCEDURE FOR BLACKLISTING

Upon receipt of or obtaining information and/or knowledge that any person(s) is involved in practices mentioned in Chapter-2 earlier, the concerned Project Authority / formation shall promptly formulate its recommendations and submit through MD NTDC to NTDC RPC along with its findings, details of charges and documentary evidences to initiate proceedings under this SOP.

4.2 INITIATION OF AN ACTION

(i) Within a period of 15 days after receiving the recommendations of Blacklisting / Debarment from the concerned Project Authority, the Convener of the Committee shall issue a Show Cause Notice ("**Notice**") thereby informing the Person about the alleged charges and shall provide an opportunity to the defend said charges within a time period of 15 (fifteen) days.

(ii) The person(s) shall be accorded adequate opportunity of hearing in order to defend the charges within the given timelines.

(iii) The Notice to the Person shall be sent at the mailing/postal address as provided under the Contract or any other address provided by way of subsequent written communication by the Person The non-receipt of the Notice due to incorrect / change in mailing address without any written communication shall not be attributable to NTDC. In case of non-receipt of any reply from the accused person within the formulated time, but not less than the time given in 4.2 (i) above, the Committee shall have the right to proceed on Ex-parte basis.

4.3 DECISION

i. The committee shall hold an independent inquiry/investigation as the case may be, and, which may include site visits and interviews with the parties concerned. The Committee shall complete the entire inquiry/investigation, preferably within a period of 30 days after receipt of response from the person against whom proceedings under this SOP have been initiated and shall present the report to the MD NTDC.

ii. If required, the Committee may report the case to an appropriate law enforcement agency depending upon the nature of the case for detailed investigations with the prior approval of Managing Director (NTDC).

iii. The person against whom proceedings have been initiated under this SOP shall not proceed for arbitration/litigation during the proceedings for blacklisting.

4.4 COMMUNICATION OF DECISION

After recommendation for blacklisting by "NTDC's Rights Protection Committee **(RPC)**", the person concerned shall be informed within 10 days of such decision. The decision of the Committee will be notified on NTDC's and PPRA's websites and shall also be conveyed to Pakistan Engineering Council. Blacklisting of firms shall also be conveyed by circular to other Government Departments. All other relevant procuring agencies including PEPCO, DISCOs, and WAPDA, etc., will also be informed simultaneously.

4.5 PERIOD OF DEBARMENT FOR BLACKLISTED FIRMS

(i) The Blacklisting on the grounds and reasons specified herein above in Chapter No.

2 shall be for a reasonable specified period of time and as a general rule of prudence, the period may not exceed three years, except in cases where debarment/blacklisting has been done by any other government department or an International Financial Institution (Donor Agency).

(ii) In case the person has been blacklisted by the government department or the International Financial Institution (donor agency), the period of blacklisting/debarment shall be for a maximum period of 3 years or the time period for which the concerned government department/International Financial Institution (Donor Agency) debarred the contractor (whichever is higher).

4.6 ACTION AFTER PERSONS A REPLACED ON BLACKLISTING LIST.

i. The decision of blacklisting will be immediately circulated to all concerned as mentioned at Clause 4.4 above.

ii. In case of a contract already awarded to a person which has been blacklisted and termination is either not possible or not feasible, the concerned Project Authority may proceed in this case to complete the contract with the approval of Competent Authority.

iii. The blacklisted person shall stand disqualified from bidding from the date of decision against them. Any pending bids shall also stand rejected. If a contract has already been awarded to person, it shall be voidable at the option of NTDC as per 4.6 (ii) above.

iv. A separate register or data base will be maintained for blacklisted firms indicating reasons and period.

4.7 EFFECTIVENESS

These guidelines / SOP or any amendments thereof shall take effect immediately after its approval from Board of Directors of NTDC.

APPENDIX-1

PROCESS TO DEAL WITH FRIVOLOUS COMPLAINTS

It has been frequently observed that after opening of tenders, the bidders start to influence the evaluation process. Such attempts result in delay in finalizing of award of contract and cause financial loss to the National exchequer. The evaluation process is confidential till publication of award of contract process.

Provision of guidelines of international donor agencies and PPRA provides sufficient opportunity to bidders for redressal of their grievances. Hence, the attempts made by the bidders during evaluation process or thereafter to influence the contract award decisions fall under the definition of corrupt and fraudulent practices. Therefore, during bidding stage, the following mechanism shall be adopted in case of receipt of any frivolous complaint from the bidder.

i. Anonymous complaints shall not be entertained.

ii. The Procuring Agency reserves the right to call for an affidavit from the complainant verifying the truthfulness and correctness of the contents of the complaint.

iii. The notice of displeasure and explanation will be immediately sent to those persons who lodge frivolous complaint(s) during the evaluation process.

iii (a) If the person itself or through its agent or any third party does not refrain from making frivolous complaints in the same tender or any other tender, an official warning will be sent and their case may be sent to "NTDC's Rights Protection Committee" which may analyse the situation and suggest action including the rejection of the bid of the complainant. However, Project Authority may reject the bid even in first instance depending upon nature of the case or provision of the Bidding Documents.

iii (b) If the same person itself or through its agent or any third party lodges a frivolous complaint in another tender floating in parallel before decision of the Grievance Committee, its bid will straight forwardly be rejected by the project authority. It may also be debarred to participate in the next tender for a minimum period of six months under intimation to the Grievance Committee and MD NTDC.

iv. In order to monitor the record of the persons, a data base will be maintained at NTDC's website and the offices of the project authorities regarding such persons who consistently lodge frivolous complaints during the evaluation process by making clandestine access to confidential record and hamper the award of contract process.

NOTE: It is clarified that the process provided above in Appendix 1 is to discourage anonymous and frivolous complaints only, and does not bar any person feeling aggrieved by any act of the procuring agency from lodging a genuine complaint/grievance as provided under Rule 48 of the PPRA Rules, 2004.

APPENDIX-2

GUIDELINES FOR EVALUATION OF PERFORMANCE OF CONTRACTORS

i. After signing of the contract, the Project authority (or the Consultant / Engineer) must monitor and evaluate the Contractor's performance, that is, whether the Contractor is fulfilling his obligations based on the terms of the contract and plans that were developed and agreed upon with the Project authority at the time of signing of contract or during kick-off meetings.

ii. Though the performance evaluation of any person is an on-going process, which takes place throughout the duration of the contract and also during the Defect Liability / Warranty Period, nevertheless, a person's Performance Evaluation Report may be prepared for the consumption and benefit of the procuring agency or for any other purpose at the completion of the project, as the case may be.

iii. The performance evaluation report shall be prepared for all contracts of more than Rs. 100 million. When based on the Evaluation Report, the performance of a person is non-satisfactory, the procuring agency may initiate the case for blacklisting of the person in accordance with the terms of this SOP. For the avoidance of doubt, consistent failure to provide satisfactory performance shall also include performances in a single or multiple contracts executed or being executed by the same person, as the case may be.

iv. In case of any extra-ordinary delay in performance of a single contract of vital and critical importance, the procuring agency shall have the right to initiate proceedings under this SOP and/or avail any other remedy provided under the law which may *interalia* include: termination of the contract, recovery of losses, debarring the person from participation in future tenders. The procuring agency shall be the sole judge to determine the projects of vital or critical importance.

v. In case of ordinary delay in performance in 2 consecutive contracts within a period of 3 years, the procuring agency shall have the right to initiate proceedings under this SOP and/or avail any other remedy provided under the law which may *interalia* include: termination of the contract, recovery of losses, debarring the person from participation in future tenders.

vi. The proceedings under this SOP shall not prejudice any other rights and/or remedies available to the procuring agency under the contrre3act documents and/or any other law in force.