VOLUME- I

Request for Bids
Goods

(One-Envelope Bidding Process)

Procurement of:

Supply of goods 132 KV Grid Station & Transmission Line Material

RFB No: ***PK-HESCO-GOODS-EQUIP-ICB/04***
Project: **Electricity Distribution Efficiency Improvement Project**
Purchaser: *Hyderabad Electric Supply Company - HESCO*
Country: *Pakistan*
Issued on:

STANDARD PROCUREMENT DOCUMENT

Request for Bids
Goods

(One-Envelope Bidding Process)

THE WORLD BANK
IBRD • IDA

JUNE 2021

Request for Bids
Goods
(One-Envelope Bidding Process)

Procurement of

132 KV Grid Station & Transmission Line Material

LOT No.	Sr No.	Description of Material
I	**-**	**132 Kv SF6 Circuit Breakers**
II	**1**	**132Kv Lightening Arrester**
	2	**11 Kv Lightening Arrester**
III	**-**	**132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for overhead transmission Lines**

RFB No: ***PK-HESCO-GOODS- EQUIP -ICB/04***
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Standard Procurement Document

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PART 1 – Bidding Procedures

Section I - Instructions to Bidders

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Section I. Instructions to Bidders

A. General

1. Scope of Bid

1.1 In connection with the Specific Procurement Notice, Request for Bids (RFB), specified **in the Bid Data Sheet (BDS),** the Purchaser, as specified **in the BDS,** issues this bidding document for the supply of Goods and, if applicable, any Related Services incidental thereto, as specified in Section VII, Schedule of Requirements. The name, identification and number of lots (contracts) of this RFB are **specified in the BDS.**

1.2 Throughout this bidding document:

(a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, including if **specified in the BDS**, distributed or received through the electronic-procurement system used by the Purchaser) with proof of receipt;

(b) if the context so requires, "singular" means "plural" and vice versa; and

(c) "Day" means calendar day, unless otherwise specified as "Business Day". A Business Day is any day that is an official working day of the Borrower. It excludes the Borrower's official public holidays.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called "Borrower") **specified in the BDS** has applied for or received financing (hereinafter called "funds") from the International Bank for Reconstruction and Development or the International Development Association (hereinafter called "the Bank") in an amount **specified in the BDS,** toward the project named **in the BDS.** The Borrower intends to apply a portion of the funds to eligible payments under the contract for which this bidding document is issued.

2.2 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank in accordance with the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the Loan account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import is prohibited by

decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Fraud and Corruption

3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Section VI.

3.2 In further pursuance of this policy, Bidders shall permit and shall cause their agents (where declared or not), sub Suppliers, sub consultants, service providers, suppliers, and personnel, to permit the Bank to inspect all accounts, records and other documents relating to any initial selection process, prequalification process, bid submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Bidders

4.1 A Bidder may be a firm that is a private entity, a state-owned enterprise or institution subject to ITB 4.6, or any combination of such entities in the form of a joint venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. Unless specified **in the BDS**, there is no limit on the number of members in a JV.

4.2 A Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this Bidding process, if the Bidder:

(a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or

(b) receives or has received any direct or indirect subsidy from another Bidder; or

(c) has the same legal representative as another Bidder; or

(d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid of another Bidder, or influence the

decisions of the Purchaser regarding this Bidding process; or

(e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or

(f) or any of its affiliates has been hired (or is proposed to be hired) by the Purchaser or Borrower for the Contract implementation; or

(g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(h) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the bidding document or specifications of the Contract, and/or the Bid evaluation process of such Contract; or (ii) would be involved in the implementation or supervision of such Contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the Bidding process and execution of the Contract.

4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate in more than one Bid, except for permitted alternative Bids. This includes participation as a sub Supplier. Such participation shall result in the disqualification of all Bids in which the firm is involved. A firm that is not a Bidder or a JV member, may participate as a sub Supplier in more than one Bid.

4.4 A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed sub Suppliers or

sub consultants for any part of the Contract including related Services.

4.5 A Bidder that has been sanctioned by the Bank, pursuant to the Bank's Anti-Corruption Guidelines, in accordance with its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework as described in Section VI paragraph 2.2 d., shall be ineligible to be prequalified for, initially selected for, bid for, propose for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified in the BDS.

4.6 Bidders that are state-owned enterprises or institutions in the Purchaser's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not under supervision of the Purchaser.

4.7 A Bidder shall not be under suspension from Bidding by the Purchaser as the result of the operation of a Bid–Securing Declaration or Proposal-Securing Declaration.

4.8 Firms and individuals may be ineligible if so indicated in Section V and (a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country.

4.9 A Bidder shall provide such documentary evidence of eligibility satisfactory to the Purchaser, as the Purchaser shall reasonably request.

4.10 A firm that is under a sanction of debarment by the Borrower from being awarded a contract is eligible to participate in this procurement, unless the Bank, at the Borrower's request, is satisfied that the debarment;

(a) relates to fraud or corruption; and

(b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Goods and Related Services

5.1 All the Goods and Related Services to be supplied under the Contract and financed by the Bank may have their origin in any country in accordance with Section V, Eligible Countries.

5.2 For purposes of this ITB, the term "goods" includes commodities, raw material, machinery, equipment, and industrial plants; and "related services" includes services such as insurance, installation, training, and initial maintenance.

5.3 The term "origin" means the country where the goods have been mined, grown, cultivated, produced, manufactured or processed; or, through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.

B. Contents of Request for Bids Document

6. Sections of Bidding Document

6.1 The bidding document consist of Parts 1, 2, and 3, which include all the sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART 1 Bidding Procedures

- Section I - Instructions to Bidders (ITB)
- Section II - Bidding Data Sheet (BDS)
- Section III - Evaluation and Qualification Criteria
- Section IV - Bidding Forms
- Section V - Eligible Countries
- Section VI - Fraud and Corruption

PART 2 Supply Requirements

- Section VII - Schedule of Requirements

PART 3 Contract

- Section VIII - General Conditions of Contract (GCC)
- Section IX - Special Conditions of Contract (SCC)
- Section X - Contract Forms

6.2 The Specific Procurement Notice, Request for Bids (RFB), issued by the Purchaser is not part of this bidding document.

6.3 Unless obtained directly from the Purchaser, the Purchaser is not responsible for the completeness of the document, responses to requests for clarification, the Minutes of the pre-Bid meeting (if any), or Addenda to the bidding document in accordance with ITB 8. In case of any contradiction, documents obtained directly from the Purchaser shall prevail.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding document and to furnish with its Bid all information or documentation as is required by the bidding document.

7. Clarification of Bidding Document

7.1 A Bidder requiring any clarification of the bidding document shall contact the Purchaser in writing at the Purchaser's address specified **in the BDS**. The Purchaser will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of Bids within a period specified **in the BDS.** The Purchaser shall forward copies of its response to all Bidders who have acquired the bidding document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so specified **in the BDS**, the Purchaser shall also promptly publish its response at the web page identified **in the BDS**. Should the clarification result in changes to the essential elements of the bidding document, the Purchaser shall amend the bidding document following the procedure under ITB 8 and ITB 22.2.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of Bids, the Purchaser may amend the bidding document by issuing addenda.

8.2 Any addendum issued shall be part of the bidding document and shall be communicated in writing to all who have obtained the bidding document from the Purchaser in accordance with ITB 6.3. The Purchaser shall also promptly publish the addendum on the Purchaser's web page in accordance with ITB 7.1.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Purchaser may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 22.2.

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Purchaser, shall be written in the language specified **in the BDS.** Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the language specified **in the BDS,** in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise the following:

(a) **Letter of Bid** prepared in accordance with ITB 12;

(b) **Price Schedules**: completed in accordance with ITB 12 and ITB 14;

(c) **Bid Security** or **Bid-Securing Declaration**, in accordance with ITB 19.1;

(d) **Alternative Bid**: if permissible, in accordance with ITB 13;

(e) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.3;

(f) **Qualifications**: documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the Contract if its Bid is accepted;

(g) **Bidder's Eligibility**: documentary evidence in accordance with ITB 17 establishing the Bidder's eligibility to bid;

(h) **Eligibility of Goods and Related Services:** documentary evidence in accordance with ITB 16, establishing the eligibility of the Goods and Related Services to be supplied by the Bidder;

(i) **Conformity**: documentary evidence in accordance with ITB 16 and 30, that the Goods and Related Services conform to the bidding document; and

(j) any other document required **in the BDS.**

11.2 In addition to the requirements under ITB 11.1, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all members and submitted with the Bid, together with a copy of the proposed Agreement.

11.3 The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid.

12. Letter of Bid and Price Schedules

12.1. The Letter of Bid and Price Schedules shall be prepared using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 20.3. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1. Unless otherwise specified **in the BDS,** alternative Bids shall not be considered.

14. Bid Prices and Discounts

14.1 The prices and discounts quoted by the Bidder in the Letter of Bid and in the Price Schedules shall conform to the requirements specified below.

14.2 All lots (contracts) and items must be listed and priced separately in the Price Schedules.

14.3 The price to be quoted in the Letter of Bid in accordance with ITB 12.1 shall be the total price of the Bid, excluding any discounts offered.

14.4 The Bidder shall quote any discounts and indicate the methodology for their application in the Letter of Bid, in accordance with ITB 12.1.

14.5 Prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to variation on any account, unless otherwise specified **in the BDS.** A Bid submitted with an adjustable price quotation shall be treated as nonresponsive and shall be rejected, pursuant to ITB 29. However, if in accordance with **the BDS**, prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract, a Bid submitted with a fixed price quotation shall not be rejected, but the price adjustment shall be treated as zero.

14.6 If so specified in ITB 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). Unless otherwise specified **in the BDS,** prices quoted shall correspond to 100 % of the items specified for each lot and to 100% of the quantities specified for each item of a lot. Bidders wishing to offer discounts for the award of more than one Contract shall specify in their Bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITB 14.4 provided the Bids for all lots (contracts) are opened at the same time.

14.7 The terms EXW, CIP, and other similar terms shall be governed by the rules prescribed in the current edition of Incoterms, published by the International Chamber of Commerce**,** as specified **in the BDS.**

14.8 Prices shall be quoted as specified in each Price Schedule included in Section IV, Bidding Forms. The disaggregation of price components is required solely for the purpose of facilitating the comparison of Bids by the Purchaser. This shall not in any way limit the Purchaser's right to contract on any of the terms offered. In quoting prices, the Bidder shall be free to use transportation through carriers registered in any eligible country, in accordance with Section V, Eligible Countries. Similarly, the Bidder may obtain insurance services from any eligible country in accordance with Section V, Eligible Countries. Prices shall be entered in the following manner:

(a) For Goods manufactured in the Purchaser's Country:

(i) the price of the Goods quoted EXW (ex-works, ex-factory, ex warehouse, ex showroom, or off-the-shelf, as applicable), including all customs duties and sales and other taxes already paid or payable on the components and raw material used in the manufacture or assembly of the Goods;

(ii) any Purchaser's Country sales tax and other taxes which will be payable on the Goods if the Contract is awarded to the Bidder; and

(iii) the price for inland transportation, insurance, and other local services required to convey the Goods to their final destination (Project Site) specified **in the BDS.**

(b) For Goods manufactured outside the Purchaser's Country, to be imported:

(i) the price of the Goods, quoted CIP named place of destination, in the Purchaser's Country, as specified **in the BDS;**

(ii) the price for inland transportation, insurance, and other local services required to convey the Goods from the named place of destination to their final destination (Project Site) specified **in the BDS;**

(c) For Goods manufactured outside the Purchaser's Country, already imported:

(i) the price of the Goods, including the original import value of the Goods; plus any mark-up (or rebate); plus any other related local cost, and custom duties and other import taxes already paid or to be paid on the Goods already imported;

(ii) the custom duties and other import taxes already paid (need to be supported with documentary evidence) or to be paid on the Goods already imported;

(iii) the price of the Goods, obtained as the difference between (i) and (ii) above;

(iv) any Purchaser's Country sales and other taxes which will be payable on the Goods if the Contract is awarded to the Bidder; and

(v) the price for inland transportation, insurance, and other local services required to convey the Goods to their final destination (Project Site) specified **in the BDS.**

(d) for Related Services, other than inland transportation and other services required to convey the Goods to their final destination, whenever such Related Services are specified in the Schedule of Requirements, the price of each item comprising the Related Services (inclusive of any applicable taxes).

15. Currencies of Bid and Payment

15.1 The currency(ies) of the Bid and the currency(ies) of payments shall be the same. The Bidder shall quote in the currency of the Purchaser's Country the portion of the Bid price that corresponds to expenditures incurred in the currency of the Purchaser's Country, unless otherwise specified **in the BDS.**

15.2 The Bidder may express the Bid price in any currency. If the Bidder wishes to be paid in a combination of amounts in different currencies, it may quote its price accordingly but

shall use no more than three foreign currencies in addition to the currency of the Purchaser's Country.

16. Documents Establishing the Eligibility and Conformity of the Goods and Related Services

16.1 To establish the eligibility of the Goods and Related Services in accordance with ITB 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms, included in Section IV, Bidding Forms.

16.2 To establish the conformity of the Goods and Related Services to the bidding document, the Bidder shall furnish as part of its Bid the documentary evidence that the Goods conform to the technical specifications and standards specified in Section VII, Schedule of Requirements.

16.3 The documentary evidence may be in the form of literature, drawings or data, and shall consist of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services, demonstrating substantial responsiveness of the Goods and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Section VII, Schedule of Requirements.

16.4 The Bidder shall also furnish a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period **specified in the BDS** following commencement of the use of the goods by the Purchaser.

16.5 Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser's satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Section VII, Schedule of Requirements.

17. Documents Establishing the Eligibility and Qualifications of the Bidder

17.1 To establish Bidder's eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid, included in Section IV, Bidding Forms.

17.2 The documentary evidence of the Bidder's qualifications to perform the Contract if its Bid is accepted shall establish to the Purchaser's satisfaction:

(a) that, if required **in the BDS**, a Bidder that does not manufacture or produce the Goods it offers to supply shall submit the Manufacturer's Authorization using the form included in Section IV, Bidding Forms to demonstrate that it has been duly authorized by the manufacturer or producer of the Goods to supply these Goods in the Purchaser's Country;

(b) that, if required **in the BDS**, in case of a Bidder not doing business within the Purchaser's Country, the Bidder is or will be (if awarded the Contract) represented by an Agent in the country equipped and able to carry out the Supplier's maintenance, repair and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications; and

(c) that the Bidder meets each of the qualification criterion specified in Section III, Evaluation and Qualification Criteria.

18. Period of Validity of Bids

18.1. Bids shall remain valid until the date **specified in the BDS** or any extended date if amended by the Purchaser in accordance with ITP 8. A Bid that is not valid until the date **specified in the BDS**, or any extended date if amended by the Purchaser in accordance with ITP 8, shall be rejected by the Purchaser as nonresponsive.

18.2. In exceptional circumstances, prior to the expiry of the Bid validity, the Purchaser may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB 19, it shall also be extended for a corresponding period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 18.3.

18.3. If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity period, the Contract price shall be determined as follows:

(a) in the case of fixed price contracts, the Contract price shall be the Bid price adjusted by the factor specified **in the BDS**;

(b) in the case of adjustable price contracts, no adjustment shall be made;

(c) in any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.

19. Bid Security

19.1. The Bidder shall furnish as part of its Bid, either a Bid-Securing Declaration or a Bid Security, as specified **in the BDS,** in original form and, in the case of a Bid Security**,** in the amount and currency specified **in the BDS.**

19.2. A Bid Securing Declaration shall use the form included in Section IV, Bidding Forms.

19.3. If a Bid Security is specified pursuant to ITB 19.1, the Bid Security shall be a demand guarantee in any of the following forms at the Bidder's option:

(a) an unconditional guarantee issued by a bank or non-bank financial institution (such as an insurance, bonding or surety company);

(b) an irrevocable letter of credit;

(c) a cashier's or certified check; or

(d) another security specified **in the BDS**,

from a reputable source, and an eligible country. If an unconditional guarantee is issued by a non-bank financial institution located outside the Purchaser's Country, the issuing non-bank financial institution shall have a correspondent financial institution located in the Purchaser's Country to make it enforceable unless the Purchaser has agreed in writing, prior to Bid submission, that a correspondent financial institution is not required. In the case of a bank guarantee, the Bid Security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Purchaser prior to Bid submission. The Bid Security shall be valid for twenty-eight (28) days beyond the original date of expiry of the Bid validity, or beyond any extended date if requested under ITB 18.2.

19.4. If a Bid Security is specified pursuant to ITB 19.1, any Bid not accompanied by a substantially responsive Bid Security shall be rejected by the Purchaser as non-responsive.

19.5. If a Bid Security is specified pursuant to ITB 19.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the Contract and furnishing the Performance Security pursuant to ITB 46.

19.6. The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security.

19.7. The Bid Security may be forfeited:

(a) if a Bidder withdraws its Bid prior to the expiry date of Bid validity specified by the Bidder on the Letter of Bid or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 45; or

(ii) furnish a Performance Security in accordance with ITB 46.

19.8. The Bid Security or Bid- Securing Declaration of a JV must be in the name of the JV that submits the Bid. If the JV has not been legally constituted into a legally enforceable JV at the time of Bidding, the Bid Security or Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.2.

19.9. If a Bid Security is not required **in the BDS**, pursuant to ITB 19.1, and

(a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid, or any extended date provided by the Bidder; or

(b) if the successful Bidder fails to: sign the Contract in accordance with ITB 45; or furnish a performance security in accordance with ITB 46;

the Borrower may, if provided for **in the BDS**, declare the Bidder ineligible to be awarded a contract by the Purchaser for a period of time as stated **in the BDS**.

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the documents comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL." Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE." In addition, the Bidder shall submit copies of the Bid, in the number **specified in the BDS** and clearly mark them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 Bidders shall mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include

proprietary information, trade secrets, or commercial or financially sensitive information.

20.3 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified **in the BDS** and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.

20.4 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

20.5 Any inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

21.1. The Bidder shall deliver the Bid in a single, sealed envelope (one-envelope Bidding process). Within the single envelope the Bidder shall place the following separate, sealed envelopes:

(a) in an envelope marked "ORIGINAL", all documents comprising the Bid, as described in ITB 11; and

(b) in an envelope marked "COPIES", all required copies of the Bid; and,

(c) if alternative Bids are permitted in accordance with ITB 13, and if relevant:

i. in an envelope marked "ORIGINAL -ALTERNATIVE", the alternative Bid; and

ii. in the envelope marked "COPIES – ALTERNATIVE BID" all required copies of the alternative Bid.

21.2. The inner and outer envelopes, shall:

(a) bear the name and address of the Bidder;

(b) be addressed to the Purchaser in accordance with ITB 22.1;

(c) bear the specific identification of this Bidding process indicated in ITB 1.1; and

(d) bear a warning not to open before the time and date for Bid opening.

21.3 If all envelopes are not sealed and marked as required, the Purchaser will assume no responsibility for the misplacement or premature opening of the Bid.

22. Deadline for Submission of Bids

22.1. Bids must be received by the Purchaser at the address and no later than the date and time specified **in the BDS.** When so specified **in the BDS**, Bidders shall have the option of submitting their Bids electronically. Bidders submitting Bids electronically shall follow the electronic Bid submission procedures specified **in the BDS**.

22.2. The Purchaser may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 8, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

23. Late Bids

23.1. The Purchaser shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 22. Any Bid received by the Purchaser after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.

24. Withdrawal, Substitution, and Modification of Bids

24.1. A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization (the power of attorney) in accordance with ITB 20.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

(a) prepared and submitted in accordance with ITB 20 and 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," or "MODIFICATION;" and

(b) received by the Purchaser prior to the deadline prescribed for submission of Bids, in accordance with ITB 22.

24.2. Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.

24.3. No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified by the Bidder on the Letter of Bid or any extension thereof.

25. Bid Opening

25.1. Except as in the cases specified in ITB 23 and ITB 24.2, the Purchaser shall, at the Bid opening, publicly open and read out all Bids received by the deadline at the date, time and place specified **in the BDS** in the presence of Bidders' designated representatives and anyone who chooses to attend Any specific electronic Bid opening procedures required if electronic bidding is permitted in accordance with ITB 22.1, shall be as specified **in the BDS.**

25.2. First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. If the withdrawal envelope does not contain a copy of the "power of attorney" confirming the signature as a person duly authorized to sign on behalf of the Bidder, the corresponding Bid will be opened. No Bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening.

25.3. Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.

25.4. Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening.

25.5. Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Bidder and whether there is a modification; the total Bid Prices, per lot (contract) if applicable, including any discounts and alternative Bids; the presence or absence of a Bid Security, if required; and any other details as the Purchaser may consider appropriate.

25.6. Only Bids, alternative Bids and discounts that are opened and read out at Bid opening shall be considered further in the evaluation. The Letter of Bid and the Price Schedules are to

be initialed by representatives of the Purchaser attending Bid opening in the manner specified **in the BDS.**

25.7. The Purchaser shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).

25.8. The Purchaser shall prepare a record of the Bid opening that shall include, as a minimum:

(a) the name of the Bidder and whether there is a withdrawal, substitution, or modification;

(b) the Bid Price, per lot (contract) if applicable, including any discounts;

(c) any alternative Bids;

(d) the presence or absence of a Bid Security or Bid-Securing Declaration, if one was required.

25.9. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E. Evaluation and Comparison of Bids

26. Confidentiality

26.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with the Bidding process until the information on Intention to Award the Contract is transmitted to all Bidders in accordance with ITB 40.

26.2 Any effort by a Bidder to influence the Purchaser in the evaluation or contract award decisions may result in the rejection of its Bid.

26.3 Notwithstanding ITB 26.2, from the time of Bid opening to the time of Contract Award, if any Bidder wishes to contact the Purchaser on any matter related to the Bidding process, it should do so in writing.

27. Clarification of Bids

27.1 To assist in the examination, evaluation, comparison of the Bids, and qualification of the Bidders, the Purchaser may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder in respect to its Bid and that is not in response to a request by the Purchaser shall not be considered. The Purchaser's request for clarification and the response shall be in writing. No change, including

any voluntary increase or decrease, in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Purchaser in the Evaluation of the Bids, in accordance with ITB 31.

27.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Purchaser's request for clarification, its Bid may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of Bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the bidding document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the bidding document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the bidding document.

29. Determination of Responsiveness

29.1 The Purchaser's determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB 11.

29.2 A substantially responsive Bid is one that meets the requirements of the bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Goods and Related Services specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the bidding document, the Purchaser's rights or the Bidder's obligations under the Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

29.3 The Purchaser shall examine the technical aspects of the Bid submitted in accordance with ITB 16 and ITB 17, in particular, to confirm that all requirements of Section VII, Schedule of Requirements have been met without any material deviation or reservation, or omission.

29.4 If a Bid is not substantially responsive to the requirements of bidding document, it shall be rejected by the Purchaser and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

30. Nonconformities, Errors and Omissions

30.1 Provided that a Bid is substantially responsive, the Purchaser may waive any nonconformities in the Bid.

30.2 Provided that a Bid is substantially responsive, the Purchaser may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities or omissions in the Bid related to documentation requirements. Such omission shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

30.3 Provided that a Bid is substantially responsive, the Purchaser shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component, by adding the average price of the item or component quoted by substantially responsive Bidders. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Purchaser shall use its best estimate.

31. Correction of Arithmetical Errors

31.1 Provided that the Bid is substantially responsive, the Purchaser shall correct arithmetical errors on the following basis:

(a) if there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the unit price shall prevail and the line item total shall be corrected, unless in the opinion of the Purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the line item total as quoted shall govern and the unit price shall be corrected;

(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

31.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 31.1, shall result in the rejection of the Bid.

32. Conversion to Single Currency

32.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted in a single currency as specified **in the BDS.**

33. Margin of Preference

33.1 Unless otherwise specified **in the BDS,** a margin of preference shall not apply.

34. Evaluation of Bids

34.1 The Purchaser shall use the criteria and methodologies listed in this ITB and Section III, Evaluation and Qualification criteria. No other evaluation criteria or methodologies shall be permitted. By applying the criteria and methodologies, the Purchaser shall determine the Most Advantageous Bid. This is the Bid of the Bidder that meets the qualification criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

34.2 To evaluate a Bid, the Purchaser shall consider the following:

(a) evaluation will be done for Items or Lots (contracts), as specified **in the BDS;** and the Bid Price as quoted in accordance with ITB 14;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 31.1;

(c) price adjustment due to discounts offered in accordance with ITB 14.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 32;

(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 30.3; and

(f) the additional evaluation factors are specified in Section III, Evaluation and Qualification Criteria.

34.3 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.

34.4 If this bidding document allows Bidders to quote separate prices for different lots (contracts), the methodology to determine the lowest evaluated cost of the lot (contract)

combinations, including any discounts offered in the Letter of Bid, is specified in Section III, Evaluation and Qualification Criteria.

34.5 The Purchaser's evaluation of a Bid will exclude and not take into account:

(a) in the case of Goods manufactured in the Purchaser's Country, sales and other similar taxes, which will be payable on the goods if a contract is awarded to the Bidder;

(b) in the case of Goods manufactured outside the Purchaser's Country, already imported or to be imported, customs duties and other import taxes levied on the imported Good, sales and other similar taxes, which will be payable on the Goods if the contract is awarded to the Bidder;

(c) any allowance for price adjustment during the period of execution of the contract, if provided in the Bid.

34.6 The Purchaser's evaluation of a Bid may require the consideration of other factors, in addition to the Bid Price quoted in accordance with ITB 14. These factors may be related to the characteristics, performance, and terms and conditions of purchase of the Goods and Related Services. The effect of the factors selected, if any, shall be expressed in monetary terms to facilitate comparison of Bids, unless otherwise specified **in the BDS** from amongst those set out in Section III, Evaluation and Qualification Criteria. The criteria and methodologies to be used shall be as specified in ITB 34.2(f).

35. Comparison of Bids

35.1 The Purchaser shall compare the evaluated costs of all substantially responsive Bids established in accordance with ITB 34.2 to determine the Bid that has the lowest evaluated cost. The comparison shall be on the basis of CIP (place of final destination) prices for imported goods and EXW prices, plus cost of inland transportation and insurance to place of destination, for goods manufactured within the Borrower's country, together with prices for any required installation, training, commissioning and other services. The evaluation of prices shall not take into account custom duties and other taxes levied on imported goods quoted CIP and sales and similar taxes levied in connection with the sale or delivery of goods.

36. Abnormally Low Bids

36.1 An Abnormally Low Bid is one where the Bid price, in combination with other constituent elements of the Bid, appears unreasonably low to the extent that the Bid price raises material concerns with the Purchaser as to the capability of the Bidder to perform the Contract for the offered Bid price.

36.2 In the event of identification of a potentially Abnormally Low Bid, the Purchaser shall seek written clarification from the Bidder, including a detailed price analyses of its Bid price in relation to the subject matter of the contract, scope, delivery schedule, allocation of risks and responsibilities and any other requirements of the bidding document.

36.3 After evaluation of the price analyses, in the event that the Purchaser determines that the Bidder has failed to demonstrate its capability to perform the contract for the offered Bid price, the Purchaser shall reject the Bid.

37. Qualification of the Bidder

37.1 The Purchaser shall determine, to its satisfaction, whether the eligible Bidder that is selected as having submitted the lowest evaluated cost and substantially responsive Bid, meets the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

37.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, sub Suppliers (other than specialized sub Suppliers if permitted in the bidding document), or any other firm(s) different from the Bidder.

37.3 Prior to Contract award, the Purchaser will verify that the successful Bidder (including each member of a JV) is not disqualified by the Bank due to noncompliance with contractual SEA/SH prevention and response obligations. The Purchaser will conduct the same verification for each sub Supplier proposed by the successful Bidder. If any proposed sub Supplier does not meet the requirement, the Purchaser will require the Bidder to propose a replacement sub Supplier.

37.4 An affirmative determination shall be a prerequisite for award of the Contract to the Bidder. A negative determination shall result in disqualification of the Bid, in which event the Purchaser shall proceed to the Bidder who offers a substantially responsive Bid with the next lowest

evaluated cost to make a similar determination of that Bidder's qualifications to perform satisfactorily.

38. Purchaser's Right to Accept Any Bid, and to Reject Any or All Bids

38.1 The Purchaser reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids at any time prior to Contract Award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

39. Standstill Period

39.1 The Contract shall not be awarded earlier than the expiry of the Standstill Period. The Standstill Period shall be ten (10) Business Days unless extended in accordance with ITB 44. The Standstill Period commences the day after the date the Purchaser has transmitted to each Bidder the Notification of Intention to Award the Contract. Where only one Bid is submitted, or if this contract is in response to an emergency situation recognized by the Bank, the Standstill Period shall not apply.

40. Notification of Intention to Award

40.1 The Purchaser shall send to each Bidder the Notification of Intention to Award the Contract to the successful Bidder. The Notification of Intention to Award shall contain, at a minimum, the following information:

(a) the name and address of the Bidder submitting the successful Bid;

(b) the Contract price of the successful Bid;

(c) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated;

(d) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the notification is addressed) was unsuccessful, unless the price information in c) above already reveals the reason;

(e) the expiry date of the Standstill Period;

(f) instructions on how to request a debriefing and/or submit a complaint during the standstill period.

F. Award of Contract

41. Award Criteria

41.1 Subject to ITB 38, the Purchaser shall award the Contract to the Bidder offering the Most Advantageous Bid. The Most Advantageous Bid is the Bid of the Bidder that meets the qualification criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

42. Purchaser's Right to Vary Quantities at Time of Award

42.1 At the time the Contract is awarded, the Purchaser reserves the right to increase or decrease the quantity of Goods and Related Services originally specified in Section VII, Schedule of Requirements, provided this does not exceed the percentages specified **in the BDS,** and without any change in the unit prices or other terms and conditions of the Bid and the bidding document.

43. Notification of Award

43.1 Prior to the date of expiry of the Bid validity and upon expiry of the Standstill Period, specified in ITB 39.1 or any extension thereof, and upon satisfactorily addressing any complaint that has been filed within the Standstill Period, the Purchaser shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification of award (hereinafter and in the Contract Forms called the "Letter of Acceptance") shall specify the sum that the Purchaser will pay the Supplier in consideration of the execution of the Contract (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

43.2 Within ten (10) Business Days after the date of transmission of the Letter of Acceptance, the Purchaser shall publish the Contract Award Notice which shall contain, at a minimum, the following information:

(a) name and address of the Purchaser;

(b) name and reference number of the contract being awarded, and the selection method used;

(c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated;

(d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor;

(e) the name of the successful Bidder, the final total contract price, the contract duration and a summary of its scope; and

(f) successful Bidder's Beneficial Ownership Disclosure Form, if specified in BDS ITB 45.1.

43.3 The Contract Award Notice shall be published on the Purchaser's website with free access if available, or in at

least one newspaper of national circulation in the Purchaser's Country, or in the official gazette. The Purchaser shall also publish the contract award notice in UNDB online.

43.4 Until a formal Contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract.

44. Debriefing by the Purchaser

44.1 On receipt of the Purchaser's Notification of Intention to Award referred to in ITB 40.1, an unsuccessful Bidder has three (3) Business Days to make a written request to the Purchaser for a debriefing. The Purchaser shall provide a debriefing to all unsuccessful Bidders whose request is received within this deadline.

44.2 Where a request for debriefing is received within the deadline, the Purchaser shall provide a debriefing within five (5) Business Days, unless the Purchaser decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes place. The Purchaser shall promptly inform, by the quickest means available, all Bidders of the extended standstill period

44.3 Where a request for debriefing is received by the Purchaser later than the three (3)-Business Day deadline, the Purchaser should provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Public Notice of Award of contract. Requests for debriefing received outside the three (3)-day deadline shall not lead to extension of the standstill period.

44.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidders shall bear their own costs of attending such a debriefing meeting.

45. Signing of Contract

45.1 The Purchaser shall send to the successful Bidder the Letter of Acceptance including the Contract Agreement, and, if specified in the BDS, a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form, if so requested, shall be submitted within eight (8) Business Days of receiving this request.

45.2 The successful Bidder shall sign, date and return to the Purchaser, the Contract Agreement within twenty-eight (28) days of its receipt.

45.3 Notwithstanding ITB 45.2 above, in case signing of the Contract Agreement is prevented by any export restrictions attributable to the Purchaser, to the country of the Purchaser, or to the use of the products/goods, systems or services to be supplied, where such export restrictions arise from trade regulations from a country supplying those products/goods, systems or services, the Bidder shall not be bound by its Bid, always provided however, that the Bidder can demonstrate to the satisfaction of the Purchaser and of the Bank that signing of the Contact Agreement has not been prevented by any lack of diligence on the part of the Bidder in completing any formalities, including applying for permits, authorizations and licenses necessary for the export of the products/goods, systems or services under the terms of the Contract.

46. Performance Security

46.1 Within twenty-eight (28) days of the receipt of Letter of Acceptance from the Purchaser, the successful Bidder, if required, shall furnish the Performance Security in accordance with the GCC 18, using for that purpose the Performance Security Form included in Section X, Contract Forms, or another Form acceptable to the Purchaser. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be acceptable to the Purchaser. A foreign institution providing a bond shall have a correspondent financial institution located in the Purchaser's Country, unless the Purchaser has agreed in writing that a correspondent financial institution is not required.

46.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Purchaser may award the Contract to the Bidder offering the next Most Advantageous Bid.

47. Procurement Related Complaint

47.1 The procedures for making a Procurement-related Complaint are as specified in the BDS.

Section II - Bid Data Sheet (BDS)

The following specific data for the goods to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

ITB Reference	A. General
ITB 1.1	The reference number of the Request for Bids (RFB) is : ***PK-HESCO-GOODS- EQUIP -ICB/04*** The Purchaser is: **Hyderabad Electric Supply Company (HESCO) Pakistan** The name of the RFB is: **Procurement of** 132 KV Grid Station & Transmission Line Material Lot-I: 132 KV SF6 Circuit Breakers Lot-II 132 KV Lightening Arrestors & 11KV Lightening Arrestor Lot-III 132KV Non Ceramic Composite Polymer Insulators (80 KN) The number and identification of lots (contracts) comprising this RFB is: **Three (03) lots.** **The bidder shall have the option to submit bid for any number of lots.**
ITB 2.1	The Borrower is: Islamic Republic of Pakistan. Implementing agency: Hyderabad Electric Supply Company (HESCO) Ministry of Energy (Power Division) Loan or Financing Agreement details/amount: a) **Agreement No IBRD – 93180** b) **Loan Amount - $195 Millions** c) **Loan Amount with HESCO as per Financing Agreement- $45.74 Millions** The name of the Project is: **Electricity Distribution Efficiency Improvement Project**
ITB 4.1	Maximum number of members in the Joint Venture (JV) shall be: **Three (03)**

ITB 4.5	A list of debarred firms and individuals is available on the Bank's external website: http://www.worldbank.org/debarr.
	B. Contents of Bidding Document
ITB 7.1	For **Clarification of Bid purposes** only, the Purchaser's address is: Chief Engineer (Dev) PMU HESCO Hyderabad House No: # A-1 HESCO Power Wing Colony, Hussainabad, Hyderabad, Sindh, Pakistan. Telephone: +92-22–9260070 Fax number: +92-22–9260525 E-mail address: i. **cedevhesco@gmail.com** ii. **cepmu@hesco.gov.pk** Requests for clarification should be received by the Purchaser no later than: **Twenty One (21) days prior to the deadline for the submission of the bids**
	C. Preparation of Bids
ITB 10.1	The language of the Bid is: ***"English"*** All correspondence exchange shall be in **English** language. The translation furnished by the bidders shall be chartered translation.
ITB 11.1 (j)	The Bidder shall submit the following additional documents in its Bid: i. Copy of the receipt of the payment of the tender fee. ii. Clause by clause commentary on purchaser's specification in context of Deviation from specification. iii. Supply record in context of Qualification of Bidder. iv. Type Test Reports of equipment to be offered if available (in this regard prospective bidders are advised to follow the details of instructions contained in the technical specifications / Special provisions which are the part of the bidding documents.

<table>
<tr><td>ITB 13.1</td><td>Alternative Bids shall not be considered.</td></tr>
<tr><td>ITB 14.5</td><td>The prices quoted by the Bidder shall be: Fixed</td></tr>
<tr><td>ITB 14.7</td><td>The Incoterms edition is: Incoterm 2020.</td></tr>
<tr><td>ITB 14.8 (b)(i)</td><td>Place of destination: CIP Regional Store Tando Muhammad Khan Road HESCO, Hyderabad - Pakistan</td></tr>
<tr><td>ITB 15.1</td><td>The Bidder is required to quote in the currency of the Purchaser’s Country the portion of the Bid price that corresponds to expenditures incurred in that currency.</td></tr>
<tr><td>ITB 17.2 (a)</td><td>Manufacturer’s authorization is: Required</td></tr>
<tr><td>ITB 17.2 (b)</td><td>After sales service is: Not required
However, successful bidder is bound to warranty clauses as per the technical specifications.</td></tr>
<tr><td>ITB 18.1</td><td>The Bid shall be valid till “1st July, 2024”.</td></tr>
<tr><td>ITB 18.3 (a)</td><td>The Bid price shall be adjusted by the following factor(s): Not Applicable</td></tr>
<tr><td>ITB 19.1</td><td>A Bid Security shall be required.
A Bid-Securing Declaration shall not be required.
The amount and currency of the Bid Security shall be
<table>
<tr><td>LOT-I</td><td>USD 30,500/- or PKR 8,544,500/-</td></tr>
<tr><td>LOT-II</td><td>USD 8,500/- or PKR 2,362,000/-</td></tr>
<tr><td>LOT-III</td><td>USD 11,600/- or PKR 3,240,000/-</td></tr>
</table></td></tr>
<tr><td>ITB 19.3(a)</td><td>The text in ITB 19.3(a) is replaced as follows;
“An unconditional guarantee issued by a Bank whereas guarantee from non banking financial institution such as insurance, bonding or surety company is not acceptable.”</td></tr>
</table>

ITB 19.3 (d)	None
ITB 20.1	In addition to the original of the Bid, the number of copies is**: Two (02)** **In addition to above 01 Softcopy (USB) is required**
ITB 20.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of**:** **i. Power of Attorney** **ii. Bid submitted by an existing or intended JV shall include an undertaking signed by all parties,** (a) **stating that all parties shall be jointly and severally liable and** *(b)* **nominating an authorized representative who shall have the authority to conduct all business for and on behalf of any and all the parties of JV during the bidding process and in the event the JV is awarded the contract during contract execution.**
	D. Submission and Opening of Bids
ITB 22.1	For **Bid submission purposes** only, the Purchaser's address is Attention: Chief Engineer (Dev) PMU HESCO Hyderabad Address: House No.A-1 HESCO Power Wing Colony Hyderabad. City: Hyderabad ZIP/Postal Code: 71000 Country: Pakistan **The deadline for Bid submission is:** Date:1st April,2024. Time: 12:30 PM Pakistan Standard Time (PST) Electronics bids are not permitted
ITB 25.1	The Bid opening shall take place at: Attention: Chief Engineer (Dev) PMU HESCO Hyderabad Address: House No.A-1 HESCO Power Wing Colony Hyderabad. City: Hyderabad ZIP/Postal Code: 71000 Country: Pakistan

	Date: 1st April,2024. Time: Immediately after bid submission deadline
ITB 25.6	The Letter of Bid and Price Schedules shall be initialed by, two-third of the committee members of the Purchaser conducting Bid opening. The bids shall be numbered, any modification to the unit or total price shall be initialed by the Representative of the Purchaser.
E. Evaluation and Comparison of Bids	
ITB 32.1	The currency that shall be used for Bid evaluation and comparison purposes to convert at the selling exchange rate all Bid prices expressed in various currencies into a single currency is: Pak Rupees (PKR). The source of exchange rate shall be: State Bank of Pakistan The date for the exchange rate shall be 14 days before bid submission date.
ITB 33.1	Margin of domestic preference shall not apply.
ITB 34.2(a)	Bids will be evaluated lot by lot. If a Price Schedule shows items listed but not priced, their prices shall be assumed to be included in the prices of other items. An item not listed in the Price Schedule shall be assumed to be not included in the Bid, and provided that the Bid is substantially responsive, the average or highest price (as specified in the BDS) of the item quoted by substantially responsive Bidders will be added to the Bid price and the equivalent total cost of the Bid so determined will be used for price comparison.
ITB 34.6	The adjustments shall be determined using the following criteria, from amongst those set out in Section III, Evaluation and Qualification Criteria: ***[refer to Section III, Evaluation and Qualification Criteria; insert complementary details if necessary]*** **(a)** Deviation in Delivery schedule: **No** **(b)** Deviation in payment schedule: **No** **(c)** The cost of major replacement component, mandatory spare parts, and service: **No** **(d)** The availability in the Purchaser's Country of spare parts and after-sales services for the equipment offered in the Bid: **No** **(e)** Life cycle costs: the costs during the life of the goods or equipment: **No** **(f)** The performance and productivity of the equipment offered: **No**

	F. Award of Contract
ITB 42	The maximum percentage by which quantities may be increased is: **15%** The maximum percentage by which quantities may be decreased is: **15%**
ITB 45. 1	The successful Bidder shall submit the Beneficial Ownership Disclosure Form.
ITB 47.1	The procedures for making a Procurement-related Complaint are detailed in the "Procurement Regulations for IPF Borrowers (Annex III)". If a Bidder wishes to make a Procurement-related Complaint, the Bidder should submit its complaint following these procedures, in writing (by the quickest means available, that is either by email or fax), to: **For the attention**: Chief Engineer (Planning & Engineering), HESCO **Purchaser**: HESCO **Email address**: **cep@hesco.gov.pk** In summary, a Procurement-related Complaint may challenge any of the following: **1.** the terms of the Bidding Documents; **2.** the Purchaser's decision to exclude a bidder from procurement process prior to Contract Award, and **3.** the Purchaser's decision to award the contract.

Section III - Evaluation and Qualification Criteria

This Section contains the criteria that the Purchaser shall use to evaluate a Bid and qualify the Bidders. No other factors, methods or criteria shall be used other than specified in this bidding document.

Contents

1. Margin of Preference (ITB 33)

Not Applicable

Most Advantageous Bid

The Purchaser shall use the criteria and methodologies listed in Section 2 and 3 below to determine the Most Advantageous Bid. The Most Advantageous Bid is the Bid of the Bidder that meets the qualification criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

2. Evaluation (ITB 34)

2.1. Evaluation Criteria (ITB 34.6)

The Purchaser's evaluation of a Bid may take into account, in addition to the Bid Price quoted in accordance with ITB 14.8, one or more of the following factors as specified in ITB 34.2(f) and in BDS referring to ITB 34.6**,** using the following criteria and methodologies.

(a) Delivery schedule. (As per Incoterms specified in the BDS)

No credit will be given to deliveries before the earliest date, and Bids offering delivery after the final date shall be treated as nonresponsive.

(b) Deviation in payment schedule. **Not Applicable**

(c) Cost of major replacement components, mandatory spare parts, and service.

Not Applicable.

(d) Availability in the Purchaser's Country of spare parts and after sales services for equipment offered in the Bid. **Not Applicable**

(e) Life Cycle Costs **Not Applicable**

(f) Performance and productivity of the equipment: **Not Applicable**

(g) Specific additional criteria **Not Applicable**

2.2. Multiple Contracts (ITB 34.4)

If in accordance with ITB 1.1, Bids are invited for individual lots or for any combination of lots, the contract will be awarded to the Bidder or Bidders offering a substantially responsive Bid(s) and the lowest evaluated cost to the Purchaser for combined lots, after considering all possible combination of lots, subject to the selected Bidder(s) meeting the required qualification criteria (this Section III, Sub-Section ITB 37 Qualification Requirements) for a lot or combination of lots as the case may be.

In determining Bidder or Bidders that offer the total lowest evaluated cost to the Purchaser for combined lots, the Purchaser shall apply the following steps in sequence:

(a) evaluate individual lots to determine the substantially responsive Bids and corresponding evaluated costs;

(b) for each lot, rank the substantially responsive Bids starting from the lowest evaluated cost for the lot;

(c) apply to the evaluated costs listed in b) above, any applicable discounts/price reductions offered by a Bidder (s) for the award of multiple contracts based on the discounts and the methodology for their application offered by the respective Bidder; and

(d) determine contract award on the basis of the combination of lots that offer the total lowest evaluated cost to the Purchaser.

2.3. Alternative Bids (ITB 13.1)

Not Applicable

3. Qualification (ITB 37)

3.1 Qualification Criteria (ITB 37.1)

After determining the substantially responsive Bid which offers the lowest-evaluated cost in accordance with ITB 34, and, if applicable, the assessment of any Abnormally Low Bid (in accordance with ITB 36) the Purchaser shall carry out the post-qualification of the Bidder in accordance with ITB 37, using only the requirements specified. Requirements not included in the text below shall not be used in the evaluation of the Bidder's qualifications.

(a) **Financial Capability**:

The Bidder shall submit audited financial statements or, if not required by the law of the Bidder's country, other financial statements acceptable to the Purchaser, for the last three (03) years prior to bid submission deadline, demonstrating the current soundness of the Bidder's financial position. For a joint venture, this requirement shall be met by each member;

(b) **Specific Experience**:

The Bidder shall demonstrate that it has successfully completed at least one (01) contract within the last seven (07) years prior to bid submission deadline, with a value of at least
USD 0.50 Million or equivalent for Lot -I,
USD 0.14 Million or equivalent for Lot -II and
USD 0.19 Million or equivalent for Lot-III
that have been successfully and substantially completed and that are similar in nature and complexity to the Goods and Related Services under the Contract. For a joint venture, this requirement may be met by all members combined. In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement

of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

(c) **Documentary Evidence**: The Bidder shall furnish documentary evidence to demonstrate that the goods it offers meet the following usage requirement:

LOT-I

1. 132 Kv SF6 Circuit Breakers

A Circuit breaker being offered shall be capable of creating, carrying, and disrupting current under normal circumstances. It shall also be capable of carrying and breaking current under the circumstances of a short circuit or on overload and shall be supplied as per attached NTDC Specification (Amended to date)..

LOT-II

1. 132 Kv Lightening Arrestors

The 132 KV Lightening arrester (Surge Arrester) shall be single phase/pole non-linear, metal-oxide resistor type surge arresters without spark gaps along with steel supporting structures, grouting bolts, terminal connector for connection to external aluminum conductor as applicable and operation on three phase solidly earthed system having voltages of 132kV, 50 Hz, A.C. systems for protection of power transformers, and other electrical equipment by limiting the lightning and transient/switching surge voltages and shall be supplied as per attached NTDC Specification (Amended to date).

2. 11 Kv Lightening Arrestors

The 11 KV Lightening arrester (Surge Arrester) shall be single phase/pole non-linear, metal-oxide resistor type surge arresters without spark gaps along with steel supporting structures, grouting bolts, terminal connector for connection to external aluminum conductor as applicable and operation on three phase solidly earthed system having voltages of 11kV, 50 Hz, A.C. systems for protection of power transformers, and other electrical equipment by limiting the lightning and transient/switching surge voltages and shall be supplied as per attached NTDC Specification (Amended to date).

LOT-III

1. **132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for overhead transmission Lines**

   The Non ceramic Composite Polymer insulators (80 KN) being offered shall be used to support the ACSR, AAA Conductor of 132 KV Transmission Lines and shall be supplied as per attached NTDC Specification (Amended to date).

(d) **Manufacturing experience and Technical Capacity**: For the items under the Contract that the bidder is a manufacturer, the Bidder shall furnish documentary evidence to demonstrate that:

   (i) it has manufactured goods of similar nature and complexity for at least 05 years, prior to the bid submission deadline; and

   (ii) its annual production capacity of goods of similar nature and complexity for each of the last 05 years prior to the bid submission deadline, is at least two (02) times the quantities specified under the contract.

(e) **Manufacturer's authorization:** A Bidder who does not manufacture an item/s where a manufacturer authorization is required in accordance with BDS ITB 17.2 (a), the Bidder shall provide evidence of being duly authorized by a manufacturer (Manufacturer's Authorization Form, Section IV, Bidding Forms), meeting the criteria in (d) (i) and (ii) above, to supply the Goods;

(f) A bidder who does not manufacture an item/s where a manufacturer authorization is not required in accordance with BDS ITB 17.2 (a), the bidder shall submit documentation on, its status as a supplier, to the satisfaction of the Purchaser *(e.g. authorized dealer/ distributor of the items).* **(Not applicable in this case)**

At the time of Contract Award, the Bidder (including each sub Supplier proposed by the Bidder) shall not be subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.

Section IV - Bidding Forms

Table of Forms

Letter of Bid

Date of this Bid submission: *[insert date (as day, month and year) of Bid submission]*

Request for Bid No.: *PK-HESCO-GOODS-EQUIP-ICB/04*
Alternative No.: [*insert identification No if this is a Bid for an alternative*]

To: **Chief Engineer (Dev) PMU HESCO Hyderabad**
Project Management Unit
***Hyderabad Electric Supply Company* Hyderabad, Pakistan**

(a) **No reservations:** We have examined and have no reservations to the bidding document, including Addenda issued in accordance with Instructions to Bidders (ITB 8);

(b) **Eligibility**: We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) **Bid/Proposal-Securing Declaration**: We have not been suspended nor declared ineligible by the Purchaser based on execution of a Bid-Securing Declaration or Proposal-Securing Declaration in the Purchaser's Country in accordance with ITB 4.7;

(d) **Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment (SH):** [*select the appropriate option from (i) to (iii) below and delete the others. In case of JV members and/or sub Suppliers, indicate the status of disqualification by the Bank of each JV member and/or sub Supplier]*.

We, including any of our sub Suppliers:

(i) [have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.]

(ii) [are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations.]

(iii) [had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations, and were removed from the disqualification list. An arbitral award on the disqualification case has been made in our favor.]

(e) **Conformity:** We offer to supply in conformity with the bidding document and in accordance with the Delivery Schedules specified in the Schedule of Requirements the following Goods: [*insert a brief description of the Goods and Related Services*];

(f) **Bid Price**: The total price of our Bid, excluding any discounts offered in item (f) below is:

Option 1, in case of one lot: Total price is: [*insert the total price of the Bid in words and figures, indicating the various amounts and the respective currencies*];

Or

Option 2, in case of multiple lots: (a) Total price of each lot [*insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies*]; and (b) Total price of all lots (sum of all lots) [*insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies*];

(g) **Discounts**: The discounts offered and the methodology for their application are:

(i) The discounts offered are: [*Specify in detail each discount offered.*]

(ii) The exact method of calculations to determine the net price after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

(h) **Bid Validity**: Our Bid shall be valid until *[insert day, month and year in accordance with ITP 18.1]*, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(i) **Performance Security**: If our Bid is accepted, we commit to obtain a performance security in accordance with the bidding document;

(j) **One Bid per Bidder**: We are not submitting any other Bid(s) as an individual Bidder, and we are not participating in any other Bid(s) as a Joint Venture member, or as a sub Supplier, and meet the requirements of ITB 4.3, other than alternative Bids submitted in accordance with ITB 13;

(k) **Suspension and Debarment**: We, along with any of our sub Suppliers, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World Bank and other development banks. Further, we are not ineligible under the Purchaser's Country laws or official regulations or pursuant to a decision of the United Nations Security Council;

(l) **State-owned enterprise or institution**: [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITB 4.6*];

(m) **Commissions, gratuities, fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Bidding process or execution of the Contract: [*insert complete name of each Recipient, its full address, the reason for which each*

commission or gratuity was paid and the amount and currency of each such commission or gratuity]

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

(n) **Binding Contract**: We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(o) **Purchaser Not Bound to Accept**: We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive; and

(p) **Fraud and Corruption**: We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption.

Name of the Bidder: *[*insert complete name of the Bidder*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: **[*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*: In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder.

**: Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Bidder Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date: *[insert date (as day, month and year) of Bid submission*]
RFB No.: *[insert number of RFB process]*
Alternative No.: *[insert identification No if this is a Bid for an alternative]*

Page _____ of_ _____ pages

1. Bidder's Name *[insert Bidder's legal name]*
2. In case of JV, legal name of each member: *[insert legal name of each member in JV]*
3. Bidder's actual or intended country of registration: *[insert actual or intended country of registration]*
4. Bidder's year of registration: *[insert Bidder's year of registration]*
5. Bidder's Address in country of registration: *[insert Bidder's legal address in country of registration]*
6. Bidder's Authorized Representative Information Name: *[insert Authorized Representative's name]* Address: *[insert Authorized Representative's Address]* Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]* Email Address: *[insert Authorized Representative's email address]*
7. Attached are copies of original documents of *[check the box(es) of the attached original documents]* ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4. ☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1. ☐ In case of state-owned enterprise or institution, in accordance with ITB 4.6 documents establishing: • Legal and financial autonomy • Operation under commercial law • Establishing that the Bidder is not under the supervision of the Purchaser 8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 45.1, the successful Bidder shall provide additional information on beneficial ownership, using the Beneficial Ownership Disclosure Form.]*

Bidder's JV Members Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. The following table shall be filled in for the Bidder and for each member of a Joint Venture].

Date: *[insert date (as day, month and year) of Bid submission*]

RFB No.: *[insert number of Bidding process]*

Alternative No.: *[insert identification No if this is a Bid for an alternative]*

Page _____ of_ _____ pages

1. Bidder's Name: *[insert Bidder's legal name]*
2. Bidder's JV Member's name: *[insert JV's Member legal name]*
3. Bidder's JV Member's country of registration: *[insert JV's Member country of registration]*
4. Bidder's JV Member's year of registration: *[insert JV's Member year of registration]*
5. Bidder's JV Member's legal address in country of registration: *[insert JV's Member legal address in country of registration]*
6. Bidder's JV Member's authorized representative information Name: *[insert name of JV's Member authorized representative]* Address: *[insert address of JV's Member authorized representative]* Telephone/Fax numbers: *[insert telephone/fax numbers of JV's Member authorized representative]* Email Address: *[insert email address of JV's Member authorized representative]*
7. Attached are copies of original documents of *[check the box(es) of the attached original documents]* ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Purchaser, in accordance with ITB 4.6. 8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 45.1, the successful Bidder shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.]*

Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment Performance Declaration

[The following table shall be filled in by the Bidder, each member of a Joint Venture and each sub Supplier proposed by the Bidder]

Bidder's Name: *[insert full name]*
Date: *[insert day, month, year]*
Joint Venture Member's or Sub Supplier's Name: *[insert full name]*
RFB No. and title: *[insert RFB number and title]*
Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration **in accordance with Section III, Qualification Criteria, and Requirements**
We: ☐ (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations ☐ (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations ☐ (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations, and were removed from the disqualification list. An arbitral award on the disqualification case has been made in our favor.
[*If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]*

Price Schedule Forms

*[The Bidder shall fill in these Price Schedule Forms in accordance with the instructions indicated. The list of line items in column 1 of the **Price Schedules** shall coincide with the List of Goods and Related Services specified by the Purchaser in the Schedule of Requirements.]*

Price Schedule: Goods Manufactured Outside the Purchaser's Country, to be Imported

(Group C Bids, goods to be imported)

Currencies in accordance with ITB 15

Date: _____
RFB No: _____

Alternative No: _____
Page N° _____ of _____

1		2	3	4	5	6	7	8	9
Line Item N°		Description of Goods	Country of Origin	Delivery Date as defined by Incoterms	Quantity and physical unit	Unit price CIP Regional Store HESCO, T.M.Khan Road Hyderabad in accordance with ITB 14.8(b)(i)	CIP Price per line item (Col. 5x6)	Price per line item for inland transportation and other services required in the Purchaser's Country to convey the Goods to their final destination specified in BDS	Total Price per Line item (Col. 7+8)
Lot.	Sr. No								
I	-	132 Kv SF6 Circuit Breakers			*40 Sets*				
II	1	132 Kv Lightening Arrestors			*100 Nos*				
	2	11 Kv Lightening Arrestors			*200 Nos.*				
III	-	132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for overhead transmission Lines			*3000 Nos*				
								Total Price	

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[Insert Date]*

Price Schedule: Goods Manufactured Outside the Purchaser's Country, already imported*

(Group C Bids, Goods already imported)
Currencies in accordance with ITB 15

Date: _____
RFB No: _____
Alternative No: _____
Page N° _____ of _____

1		2	3	4	5	6	7	8	9	10	11	12
Line Item N°		Description of Goods	Country of Origin	Delivery Date as defined by Incoterms	Quantity and physical unit	Unit price including Custom Duties and Import Taxes paid, in accordance with ITB 14.8(c)(i)	Custom Duties and Import Taxes paid per unit in accordance with ITB 14.8(c)(ii) , [to be supported by documents]	Unit Price net of custom duties and import taxes, in accordance with ITB 14.8 (c) (iii) (Col. 6 minus Col.7)	Price per line item net of Custom Duties and Import Taxes paid, in accordance with ITB 14.8(c)(i) (Col. 5×8)	Price per line item for inland transportation and other services required in the Purchaser's Country to convey the goods to their final destination, as specified in BDS in accordance with ITB 14.8 (c)(v)	Sales and other taxes paid or payable per item if Contract is awarded (in accordance with ITB 14.8(c)(iv)	Total Price per line item (Col. 9+10)
Lot	S No.											
I	-	132 Kv SF6 Circuit Breakers			*40 Sets..*							
II	1	132 Kv Lightening Arrestors			*100 Nos.*							
	2	11KV Lightening Arrestors			*200 Nos.*							
III	-	132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for over head transmission Lines			*3000 Nos*							
											Total Bid Price	

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[Insert Date]*

** [For previously imported Goods, the quoted price shall be distinguishable from the original import value of these Goods declared to customs and shall include any rebate or mark-up of the local agent or representative and all local costs except import duties and taxes, which have been and/or have to be paid by the Purchaser. For clarity the Bidders are asked to quote the price including import duties, and additionally to provide the import duties and the price net of import duties which is the difference of those values.]*

Price and Completion Schedule - Related Services

Currencies in accordance with ITB 15					Date: _____ RFB No: _____ Alternative No: _____ Page N° _____ of _____	
1	2	3	4	5	6	7
Service N°	Description of Services (excludes inland transportation and other services required in the Purchaser's Country to convey the goods to their final destination)	Country of Origin	Delivery Date at place of Final destination	Quantity and physical unit	Unit price	Total Price per Service (Col. 5*6 or estimate)
[insert number of the Service]	*[insert name of Services]*	*[insert country of origin of the Services]*	*[insert delivery date at place of final destination per Service]*	*[insert number of units to be supplied and name of the physical unit]*	*[insert unit price per item]*	*[insert total price per item]*
				Total Bid Price		

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[insert date]*

Price Schedule: Goods Manufactured in the Purchaser's Country

Purchaser's Country _____	(Group A and B Bids) Currencies in accordance with ITB 15	Date: _____ RFB No: _____ Alternative No: _____ Page N° _____ of _____

1		2	3	4	5	6	7	8	9	10
Line Item N°		Description of Goods	Delivery Date as defined by Incoterms	Quantity and physical unit	Unit price EXW	Total EXW price per line item (Col. 4×5)	Price per line item for inland transportation and other services required in the Purchaser's Country to convey the Goods to their final destination	Cost of local labor, raw materials and components from with origin in the Purchaser's Country % of Col. 5	Sales and other taxes payable per line item if Contract is awarded (in accordance with ITB 14.8(a)(ii)	Total Price per line item (Col. 6+7)
Lot	Sr No.									
I	-	132 Kv SF6 Circuit Breakers		*40 Sets..*						
II	1	132 Kv Lightening Arrestors		*100 Nos.*						
	2	11 Kv Lightening Arrestors		*200 Nos.*						
III	-	132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for over head transmission Lines		*3000 Nos.*						
									Total Price	

Name of Bidder *[insert complete name of Bidder]* Signature of Bidder *[signature of person signing the Bid]* Date *[insert date]*

Form of Bid Security

(Bank Guarantee)

[The bank shall fill in this Bank Guarantee Form in accordance with the instructions indicated.]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[*Chief Engineer (Dev) PMU HESCO Hyderabad
House No: # A-1 HESCO Power Wing Colony,
Hussainabad, Hyderabad,
Sindh, Pakistan.*]*

RFB No.: *PK-HESCO-GOODS-EQUIP-ICB/04*

Alternative No*.: [Insert identification No if this is a Bid for an alternative]*

Date: *[Insert date of issue]*

BID GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ *[insert name of the Bidder, which in the case of a joint venture shall be the name of the joint venture (whether legally constituted or prospective) or the names of all members thereof]* (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Bid (hereinafter called "the Bid") for the execution of _____ under Request for Bids No. _____ _ ("the RFB").

Furthermore, we understand that, according to the Beneficiary's conditions, Bids must be supported by a Bid guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:

(a) has withdrawn its Bid prior to the Bid validity expiry date set forth in the Applicant's Letter of Bid, or any extended date provided by the Applicant; or

(b) having been notified of the acceptance of its Bid by the Beneficiary prior to the expiry date of the Bid validity or any extension thereof provided by the Applicant has failed to: (i) sign the contract agreement, or (ii) furnish the performance security, in accordance with the Instructions to Bidders ("ITB") of the Beneficiary's bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the Contract agreement signed by the Applicant and the performance security issued to the Beneficiary in relation to such Contract agreement; or (b) if the Applicant is not the successful Bidder, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Bidding process; or (ii) twenty-eight days after the expiry date of the Bid validity.

Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

_____

[Signature(s)]

Note: All italicized text is for use in preparing this form and shall be deleted from the final product.

Form of Bid Security (Bid Bond)

[The Surety shall fill in this Bid Bond Form in accordance with the instructions indicated.]

BOND NO. _____

BY THIS BOND *[name of Bidder]* as Principal (hereinafter called "the Principal"), and *[name, legal title, and address of surety],* **authorized to transact business in** *Pakistan,* as Surety (hereinafter called "the Surety"), are held and firmly bound unto Chief Engineer (Dev) PMU HESCO Hyderabad House No: # A-1 HESCO Power Wing Colony, Hussainabad, Hyderabad, Sindh, Pakistan as Obligee (hereinafter called "the Purchaser") in the sum of *[amount of Bond]*[1] *[amount in words]*, for the payment of which sum, well and truly to be made, we, the said Principal and Surety, bind ourselves, our successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has submitted or will submit a written Bid to the Purchaser dated the ___ day of _____, 20__, for the supply of *[name of Contract]* (hereinafter called the "Bid").

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal:

(a) withdraws its Bid prior to the Bid validity expiry date set forth in the Principal's Letter of Bid, or any extended date provided by the Principal; or

(b) having been notified of the acceptance of its Bid by the Purchaser prior to the expiry date of the Bid validity or any extension thereto provided by the Applicant has failed to: (i) execute the Contract agreement; or (ii) furnish the Performance Security, in accordance with the Instructions to Bidders ("ITB") of the Purchaser's bidding document.

then the Surety undertakes to immediately pay to the Purchaser up to the above amount upon receipt of the Purchaser's first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.

The Surety hereby agrees that its obligation will remain in full force and effect up to and including the date 28 days after the date of expiry of the Bid validity set forth in the Principal's Letter of Bid or any extension thereto provided by the Principal.

IN TESTIMONY WHEREOF, the Principal and the Surety have caused these presents to be executed in their respective names this ____ day of _____ 20__.

Principal: _____ Surety: _____

Corporate Seal (where appropriate)

_____ _____

(Signature) *(Signature)*

(Printed name and title) *(Printed name and title)*

[1] The amount of the Bond shall be denominated in the currency of the Purchaser's Country or the equivalent amount in a freely convertible currency.

Form of Bid-Securing Declaration

Not Applicable

[The Bidder shall fill in this Form in accordance with the instructions indicated.]

Date: *[date (as day, month and year)]*
Bid No.: *[number of RFB process]*
Alternative No.: *[insert identification No if this is a Bid for an alternative]*

To: Chief Engineer (Dev) PMU HESCO Hyderabad
House No: # A-1 HESCO Power Wing Colony,
Hussainabad, Hyderabad,
Sindh, Pakistan.

We, the undersigned, declare that:

We understand that, according to your conditions, Bids must be supported by a Bid-Securing Declaration.

We accept that we will automatically be suspended from being eligible for bidding or submitting proposals in any contract with the Purchaser for the period of time specified in Section II – Bid Data Sheet, if we are in breach of our obligation(s) under the Bid conditions, because we:

(a) have withdrawn our Bid prior to the expiry date of the Bid validity specified in the Letter of Bid or any extended date provided by us; or

(b) having been notified of the acceptance of our Bid by the Purchaser prior to the expiry date of the Bid validity in the Letter of Bid or any extended date provided by us, (i) fail or refuse to sign the Contract; or (ii) fail or refuse to furnish the Performance Security, if required, in accordance with the ITB.

We understand this Bid Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) twenty-eight days after the expiry date of the Bid validity.

Name of the Bidder***** _____

Name of the person duly authorized to sign the Bid on behalf of the Bidder****** _____

Title of the person signing the Bid _____

Signature of the person named above _____

Date signed _____ day of _____, _____

*****: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder

******: Person signing the Bid shall have the power of attorney given by the Bidder attached to the Bid

[Note: In case of a Joint Venture, the Bid-Securing Declaration must be in the name of all members to the Joint Venture that submits the Bid.]

Manufacturer's Authorization

*[The Bidder shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. The Bidder shall include it in its Bid, if so indicated in the **BDS.**]*

Date: *[insert date (as day, month and year) of Bid submission]*
RFB No.: *[insert number of RFB process]*
Alternative No.: *[insert identification No if this is a Bid for an alternative]*

To: Chief Engineer (Dev) PMU HESCO Hyderabad
House No: # A-1 HESCO Power Wing Colony,
Hussainabad, Hyderabad,
Sindh, Pakistan.

WHEREAS

We *[insert complete name of Manufacturer]*, who are official manufacturers of *[insert type of goods manufactured]*, having factories at [insert full address of Manufacturer's factories], do hereby authorize *[insert complete name of Bidder]* to submit a Bid the purpose of which is to provide the following Goods, manufactured by us *[insert name and or brief description of the Goods]*, and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with Clause 28 of the General Conditions of Contract, with respect to the Goods offered by the above firm.

We confirm that we do not engage or employ forced labor or persons subject to trafficking or child labor, in accordance with Clause 14 of the General Conditions of Contract.

Signed: *[insert signature(s) of authorized representative(s) of the Manufacturer]*

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*

Title: *[insert title]*

Dated on _____ day of _____, _____ *[insert date of signing]*

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Non Consulting Services in Bank-Financed Procurement

In reference to ITB 4.8 and ITB 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this Bidding process.

Under ITB 4.8(a) and ITB 5.1: *None*

Under ITB 4.8(b) and ITB 5.1: *None*

Section VI - Fraud and Corruption

(Section VI shall not be modified)

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, Suppliers and suppliers; any sub-Suppliers, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-Suppliers, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring mis procurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Bank's Anti- Corruption Guidelines, and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;[1] (ii) to be a nominated[2] sub-Supplier, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, Suppliers, and suppliers, and their sub-Suppliers, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect[3] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

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1 For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-Supplier, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

2 A nominated sub-Supplier, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

3 Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

PART 2 – Supply Requirements

Section VII - Schedule of Requirements

Contents

1. List of Goods and Delivery Schedule

Line Item N°		Description of Goods	Quantity	Physical unit	Final Destination (Project Site) as specified in BDS	Delivery (as per Incoterms) Date		
						Earliest Delivery Date	Latest Delivery Date	Bidder's offered Delivery date [*to be provided by the Bidder*]
Lot	Sr.#							
I	-	132 Kv SF6 Circuit Breakers	*40*	Sets	*Regional Store HESCO, T.M.Khan Road Hyderabad*	*180 days*	*180 Days*	
II	1	132 Kv Lightening Arrestors	*100*	Nos.				
	2	11 Kv Lightening Arrestors	*200*	Nos.				
III	-	132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for overhead transmission Lines	*3000*	Nos.				

Not Applicable

2. List of Related Services and Completion Schedule

Service	Description of Service	Quantity[1]	Physical Unit	Place where Services shall be performed	Final Completion Date(s) of Services
[insert Service No]	*[insert description of Related Services]*	*[insert quantity of items to be supplied]*	*[insert physical unit for the items]*	*[insert name of the Place]*	*[insert required Completion Date(s)]*

1. If applicable

3. Technical Specifications

1. GENERAL

1.1 All design, equipment, material and workmanship shall comply with and be tested in accordance with requirements of the Specifications as attached in Volume-II of this bidding document. Equipment or parts which are not covered by the Specifications, shall comply with rules, codes and regulations of the International Electro technical Commission or National Transmission and Dispatch Company Pakistan Specifications.

1.2 The general intent of these specifications is to require the supply of equipment and materials equal or superior to those actually described herein. Unless otherwise stated, reference to the brand or manufacture, if made is only for the sake of comparison as to type, design, character or quality of the equipment and materials desired and shall not be interpreted as eliminating other equipment and materials of equal performance quality and durability.

1.3 All questions arising as to the acceptability or other wise of the equipment and materials offered shall be decided by the Chief Engineer (Dev) PMU HESCO Hyderabad whose decision shall be final.

1.4 All dimensions and units given by the Bidder in the Bid with its associated drawings and the Approval Drawings as submitted by the Supplier shall be in metric system and all reference to weights, measurements and quantities shall be metric units.

1.5 The contract shall be executed in strict conformity with the specifications and/or drawings given or mentioned in this section and the supplier shall do no `Work` without proper specifications, instructions and/or drawings.

1.6 All the goods, the quantities of which are defined in Schedule of Prices for main equipment, shall be of the material in accordance with the Technical Specifications appended hereto.

1.7 Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the goods and materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards or codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national or relates to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be acceptable.

1.8 Goods and material specified in the Technical Specification must comply with standards cited or other recognized standards, which ensure an equal or higher quality than the standards mentioned.

1.9 The updated specifications will be applicable.

1.10 The specifications/ drawings will be read in connection with the amendments provided along with the specifications /drawings.

2. MATERIAL AND WORKMANSHIP

2.1. MATERIALS

All design, equipment and material shall be of highest grade, free from defects/imperfection and shall comply with and be tested in accordance with requirements of the specifications. Equipment or parts, which are not covered by the specifications, shall comply with rules, codes and regulations of the international Electro-Technical Commission or National Transmission and Dispatch Company Pakistan Specifications. All necessary tests shall be performed to ensure that technical requirements are fulfilled.

2.2. The general intent of these Specifications is to require the supply of equipment and materials equal or superior to those actually described herein. Unless otherwise stated, reference to the brand or manufacturer, if made, is only for the sake of comparison as to type, design, character or quality of the equipment and materials desired and shall not be interpreted as eliminating other equipment and materials of equal performance, quality and durability.

2.3. All dimensions and units given by the bidder in the bid and with its associated drawings and the drawings submitted by the Supplier for approval shall be in metric system and all reference to weights, measurements and quantities shall be in metric units.

3.4. WORKMANSHIP

3.4.1. Workmanship and general finish shall be of the highest standard free from defects/Imperfection, in accordance with the requirements specified herein, and the best modern standard practice.

3.4.2. All components of the same design and designation shall be the best modern practices identical and like components shall be interchangeable. All necessary tests shall be performed to ensure that technical requirements are fulfilled.

4. SPECIFICATIONS AND DRAWINGS

3.1. The Contract shall be executed in strict conformity with the technical provisions' specification and/ or Drawings given or mentioned in this section and the supplier shall do no 'Work' without proper specification, Instructions and/or Drawings.

3.2. Specifications and/or drawings are intended to complement each other so that if anything is shown on the drawings as required but not mentioned in the Specifications or vice versa, it shall be of like effect as if shown or mentioned in both. If any errors, omissions or discrepancies are found in the figures, specifications and/or drawings or, if any feature shall appear to the Supplier to be indefinite or unclear, the same shall be referred to the Chief Engineer (Dev) PMU HESCO Hyderabad whose written explanation and/or clarification shall be obtained before proceeding with the work.

3.3. Approval of the Chief Engineer (Dev) PMU HESCO Hyderabad does not relieve the Supplier of his responsibility to do the work in accordance with the Contract.

3.4. The Supplier shall be responsible for any discrepancies, errors or omissions in any drawings or other particulars supplied by him whether such drawings or particulars have been approved by the Chief Engineer (Dev) PMU HESCO Hyderabad or not.

3.5. All drawings and documents furnished by the Supplier in accordance with the Contract shall become the property of HESCO (Client of Project).

5. TECHNICAL SPECIFICATIONS

4.1. All the goods and equipment, the quantities of which are defined in Price Schedules, shall be of the material in accordance with the Technical Provisions & Technical Specifications appended hereto.

4.2. Goods & material specified in the Technical Provisions & Technical Specification must comply with standards cited or other recognized standards, which ensure an equal or higher quality than the standards mentioned.

6. Specifications

S.#	DESCRIPTION	NTDC Specification	Remarks
1	132 Kv SF6 Circuit Breakers	P193:2010	Attached in Volume II of this Bidding Document
2	132 Kv Lightening Arrestors	P-181:2012	Attached in Volume II of this Bidding Document
3	11 Kv Lightening Arrestors	P-181:2012	Attached in Volume II of this Bidding Document
4	132 Kv Non Ceramic Composite Polymer Insulators (80 KN) for overhead transmission Lines	TLMS-8A	Attached in Volume II of this Bidding Document

6. LANGUAGE

All correspondence, literature, drawings, name plates, diagrams, applicable data, equipment details, instructions and maintenance books and manuals, spare parts, books and descriptive data shall be in the English language.

SPECIAL PROVISIONS

SP-1 SCOPE OF SUPPLY

The scope includes Procurement of Grid Station and Transmission Line material (Detail as per Price schedule) but not limited to design, manufacturing & testing, furnishing, insuring, marine transportation & delivering the material.

SP-2 ENGINEERING DATA

A. Submission and Approval

(1) The furnishing of engineering data by the Supplier shall be in accordance with the Schedule as specified in the Bidding Document. The review of these data by the Purchaser will cover only general conformance of the data to the specifications and not a thorough review of all dimensions, quantities and details of the materials, or items indicated or the accuracy of the information submitted. This review by the Purchaser shall not be considered by the Supplier, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications.

(2) All engineering data submitted by the Supplier after review by the Purchaser shall form part of the contract document.

(3) In no case the approval by the Purchaser of any document does imply compliance with technical requirements nor the absence of errors in such documents.

(4) If errors are discovered any time during the validity of the contract, then the Supplier shall be responsible for consequences.

SP-3 DRAWINGS

The Bidders/Supplier are required to submit drawings of its offered equipment during different stages of the tender/contract. Following are various categories of the drawings referred in this document:

A. Type/Categories of Drawings

i. Specification Drawings

The specification drawings are the drawings indicating general/tentative requirements of the goods/equipment for the bidders to prepare their bids.

ii. Bid Drawings

The bid drawings are the drawings prepared by the Bidder for bidding purposes, and shall be part of his Bid. Supplier's bid drawings shall not be used for manufacturing of Goods unless specific instructions for such use are given by the Purchaser.

iii. Drawings for Approval

These drawings are the drawings submitted by the Supplier for the purpose of acquiring approval of the Chief Engineer (Dev) PMU HESCO Hyderabad prior to start manufacturing of goods.

iv. Approved Drawings

These are the drawings approved by the Chief Engineer (Dev) PMU HESCO Hyderabad and the manufacturing of goods/equipment shall be carried out in accordance with the Approved drawings & data.

v. As-Built Drawings

The Supplier shall submit as-built drawings/data to the Chief Engineer (Dev) PMU HESCO Hyderabad as detailed in clause 3(C) below, which shall incorporate all changes made in the equipment during contract execution.

B. Drawings/data for Approval & Approved Drawings

i. General:

The Supplier shall submit detailed drawings/Specific Works Data for approval by the Chief Engineer (Dev) PMU HESCO Hyderabad in accordance with provisions of Contract and the additional requirements specified in the respective Clauses hereof. The drawings/data shall be complete in all respects, shall have been reviewed and checked by the Supplier and shall be submitted in due time and in logical order to facilitate proper coordination.

If any errors, omissions or discrepancies are found in the figures, specifications and/or drawings or, if any feature shall appear to the supplier to be indefinite or unclear, the same shall be referred to the Chief Engineer (Dev) PMU HESCO Hyderabad whose written explanation and/or clarification shall be obtained before proceeding with the work.

The Supplier shall allow **one (01) month** for the Engineer's approval of drawings in his schedule of work and in the time allowed for completion of the contract. Extra time

required for approval of drawings due to deficiencies in design or errors in submitted drawings shall be the responsibility of the supplier and no extension in time will be allowed on this account.

The sequence of submission of all drawings shall be such that all information is available for checking each drawing when it is received.

All drawings and documents furnished by the Supplier in accordance with the Contract shall become the property of the Purchaser.

All approved drawings/data shall form part of the Contract. If revisions are required after a drawing/data has been approved, the Supplier shall furnish for approval additional copies specified for the initial submission, prior to such revision(s).

Approval by the Chief Engineer (Dev) PMU HESCO Hyderabad does not relieve the Supplier of his responsibility to do the work in accordance with the Contract.

The Supplier shall be responsible for any discrepancies, errors or omissions in any drawings or other particulars supplied by him whether such drawings or particulars have been approved by the Chief Engineer (Dev) PMU HESCO Hyderabad or not.

ii. Format for submission of drawings/data for approval:

All drawings shall be in English language and all dimensions shall be in Metric System. Symbols shall be in accordance with IEC standards. All drawings shall be clearly marked "Hyderabad Electric Supply Company (HESCO)**.** All drawings/data submitted for approval shall conform to ISO paper sizes A0 or A4.

All drawings submitted for approval shall be provided with a blank white space, approximately 90 mm in height by 120 mm in width, near the lower right-hand corner to be used for notations by the Purchaser.

Drawings for approval, shall be distributed through international couriers to addresses and in number as specified above.

iii. Drawings & Specific Plant Data to be submitted for Purchaser's Approval:

The Supplier shall submit the drawings and Specific Plant Data as required in the relevant NTDC Specificfations and as descripted above , in hard copy as well as soft copy (in PDF) within fifteen (**15**) days after issuance of Notification of Award for approval of the Purchaser, together with overall and handling weights and dimensions of the Goods to be provided under the Contract. Any other information and drawing which may be required by the Chief Engineer (Dev) PMU HESCO Hyderabad or the Supplier understand that it will be deemed necessary for smooth execution of project

Manufacturer's design Engineer shall visit office of Chief Engineer (Dev) PMU HESCO Hyderabad during review & approval of specific plant data/technical data & drawings and it shall be arranged by the Supplier.

iv. Process of Approval of Drawings/Data

(1) All changes/corrections will be made on the relevant submitted drawings/data and will be marked "APPROVED", "APPROVED EXCEPT AS NOTED" or "RETURNED FOR CORRECTION" by the Chief Engineer (Dev) PMU HESCO Hyderabad. One print will be returned to the Supplier. The other shall be retained by the Chief Engineer (Dev) PMU HESCO Hyderabad for his own use and shall serve as the Master Copy and shall prevail in case of any doubt or discrepancy subsequently arising.

(2) If the drawing/data is returned to the Supplier stamped "APPROVED" he may immediately proceed with manufacturing of Goods. Any drawing/data marked "APPROVED" by the Chief Engineer (Dev) PMU HESCO Hyderabad shall be known as an "Approved Drawing".

(3) If the drawing/data is returned to the Supplier stamped "APPROVED EXCEPT AS NOTED" he may proceed with the manufacturing of Goods taking into account the corrections and comments noted on the drawing/data. The Supplier shall revise the drawings/data as required and resubmit them in the same routine as before for record purposes.

(4) If the drawing/data is returned to the Supplier stamped "RETURNED FOR CORRECTION" he shall not proceed with the manufacturing of Goods but shall make the changes and corrections or prepare new drawings/data and resubmit the revised drawing/data to the Chief Engineer (Dev) PMU HESCO Hyderabad for approval at no change in price or Delivery & Completion Schedule. Resubmitted prints and calculations will be subject to the same routine as stated before. Time required for such revisions and re-submittals of drawings/data or calculations will not entitle the Supplier to any extension in Contractual Completion time.

(5) If the Supplier does not agree with exceptions taken by the Chief Engineer (Dev) PMU HESCO Hyderabad, the Supplier shall state in his letter of re-submittal his reasons for not complying with the Chief Engineer (Dev) PMU HESCO Hyderabad's exceptions. Revision number and date and description of change shall be shown on all drawings or calculations revised.

(6) Methods of packing, marking and shipping shall be submitted to the Chief Engineer (Dev) PMU HESCO Hyderabad for review and acceptance. Before any shipment is made, the Supplier shall get the packing detailed drawings approved by the Chief Engineer (Dev) PMU HESCO Hyderabad.

iv. Manufacturing Prior to Purchaser's approval of Drawings/data

Any manufacturing/fabrication of Goods done prior to the approval of drawings & data shall be at the Supplier's risk. The Chief Engineer (Dev) PMU HESCO Hyderabad shall have the right to reject the said Goods if not conforming to required specifications and drawings or to request additional details and to require the Supplier to make any change(s) which are necessary to conform to the provisions and intent of these Specifications and such changes shall be made without additional cost to Purchaser. The approval of the drawings & data by the Chief Engineer (Dev) PMU HESCO Hyderabad shall not be construed as a complete check but will indicate only that the detailing is satisfactory. Approval by the Chief Engineer (Dev) PMU HESCO Hyderabad of the Supplier's drawings & data shall not be held to relieve the Supplier of his obligations to meet all the requirements of these Specifications or the responsibility for the correctness of the Supplier's drawings & data or for correct fit and use of assembled Goods furnished by the Supplier.

C. As-Built Data, Drawings & Documents

The Supplier shall submit as built drawings, specific woks data and documents on USB Drive, as detailed below, within five (**05**) days after issuance of Inspection Certificate (IC) to Chief Engineer (Dev) PMU HESCO Hyderabad

D. Distribution of Drawings and Documents

The drawings and documents shall be submitted to the Chief Engineer (Dev) PMU HESCO Hyderabad within the time given in the Contract or within such reasonable time as the Chief Engineer (Dev) PMU HESCO Hyderabad may require, and in the number as specified hereunder:

Documents		Purchaser/ Project Director
Drawings for approval		4
Approved Drawings		3
Schedules, specifications and other documents/data		3
Record (As-Built) Drawings and Data		6
Reproducible transparency		2
Record (As-Built) Drawings in pdf format		2

Codes and standards	2
Manufacturing progress information	4
Insurance Certificates	3
Receiving reports	3
Damage reports	3
Correspondence with Purchaser	2
Correspondence with Head office of Purchaser	2

SP-4 STANDARDS AND TYPICAL DESIGN

4.1 General

The Specifications cite or imply International Standards and typical design for Goods. Other equivalent standards and typical designs are equally acceptable provided that they in no way detract from the quality, safety, operation ability of the Goods furnished. However, when standards or typical design other than those cited or implied are offered by a bidder, he shall set forth in his Contract 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 no alternatives are set forth by the bidder, it will be assumed that offered Goods will be in accordance with the International Standards and typical design as cited or implied in the Specifications.

Where the documents provide requirements for manufacturing by specifying a standard such as, for example, one of the international standard organizations which have 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 Chief Engineer (Dev) PMU HESCO Hyderabad are at least equal to the requirements of the standards specified. The bidder may propose an equivalent standard other than that specified, in which case he shall submit the proposed standard and all other information required by the Chief Engineer (Dev) PMU HESCO Hyderabad and shall submit written demonstration that his proposed standard is equivalent 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 bid.

4.2 Applicable Standards and Codes

(1) All Goods 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.

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

SP-5 PORT OF ENTRY AND DISEMBARKATION

The Supplier would have the option to use either Karachi Port or Port Muhammad Bin Qasim or both or any other seaport in Pakistan as the port(s) of entry and disembarkation, at his own risk and costs. For the purpose of clarification, the term "Wharf at the Port of Karachi" wherever used throughout this document shall mean:

(a) Wharf at the Port of Karachi, and/or
(b) Wharf at the Port of Muhammad Bin Qasim

SP-6 PACKING AND MARKING

As discussed above

SP-7 TRANSPORTATION OF GOODS

7.1 General

The Supplier outside from the Purchaser's country shall transport the Goods from its place of manufacture or origin to the Purchaser's port and insurance thereof from its place of manufacturer up to **Regional Store HESCO TM Khan Road Hyderabad** and shall be solely responsible for selection of routes and carriers, and expediting in order that all shipments are safely and expeditiously transported and arrived at Karachi Sea Port.

SP-8 SHOP INSPECTION AND ORDERS FOR GOODS

8.1 Inspection

Unless otherwise authorized by the Chief Engineer (Dev) PMU HESCO Hyderabad no Goods shall be shipped from its point of original manufacture or final shop assembly before it has been inspected and approved by the Chief Engineer (Dev) PMU HESCO Hyderabad.

8.2 **Goods Orders**

The Supplier shall, if requested, provide the Chief Engineer (Dev) PMU HESCO Hyderabad with unpriced/priced copies of the Supplier's purchase orders for Goods or approved sub-Contracted supply at the time any such orders are placed. The Supplier shall also provide the Chief Engineer (Dev) PMU HESCO Hyderabad with any other relevant information requested to ensure proper expediting and scheduling of the deliveries.

8.3 **Acceptance of Materials**

The approval by the Chief Engineer (Dev) PMU HESCO Hyderabad of any Goods prior to shipment shall in no way relieve the Supplier of any of his responsibilities for meeting all of the requirements of the Specifications and shall not prevent subsequent rejection if such Goods are later found to be defective or not conforming to the Specifications.

SP-9 SCHEDULE AND MEETINGS

9.1 **Schedule**

(1) The Supplier shall manufacture & supply the Goods in accordance with the dates/periods specified in Delivery & Completion Schedule given herein above. The Supplier shall regularly review the Schedule and notify the Chief Engineer (Dev) PMU HESCO Hyderabad promptly of any revisions which in his view may be required from time to time.

(2) Each group of Goods shall be completely delivered. The Supplier shall keep the Chief Engineer (Dev) PMU HESCO Hyderabad informed of the progress of the Contract and notify the Chief Engineer (Dev) PMU HESCO Hyderabad approximately eight (08) weeks in advance, in writing, as to when the Goods will be ready for inspection and for shipping and shall supply lists covering each consignment in sufficient detail to enable the Chief Engineer (Dev) PMU HESCO Hyderabad to check the contents of the packages.

(3) In preparing the Delivery and Completion Schedule, the Supplier shall fully take into account the requirements (and possibilities) for ocean (or air) freight. Progress of all shipments shall be continuously monitored and the Supplier shall provide staff or agents to expedite all shipments to ensure compliance with the approved Delivery Schedule.

9.2 **Meetings**

(1) Soon after the date of Award of Contract, the Chief Engineer (Dev) PMU HESCO Hyderabad may, require a meeting with the Supplier at HESCO Head Quarter at Hyderabad / WAPDA House, Lahore or at a place or mode, mutually agreed upon to discuss scheduling of drawings & data, manufacture, testing & inspection, scheduled sequences of delivery and other similar problems which may be pertinent to the completion of the Project.

(2) From time to time during the execution of the Contract, the Chief Engineer (Dev) PMU HESCO Hyderabad may call meetings as deemed necessary for the purpose of progress monitoring and proper execution of the Contract.

(3) As required by the Chief Engineer (Dev) PMU HESCO Hyderabad, responsible representatives of the Supplier shall attend such meetings.

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

SP-10 ADDITIONAL TEST(S)

The purchaser reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/laboratory or at any other recognized laboratory/research institute in addition to the type, acceptance and routine tests as mentioned in the specifications attached here to, at the cost of the purchaser to satisfy that the material complies with the intent of this specification.

SP-11 LANGUAGE

All correspondence, literature, drawings, name plates, diagrams, applicable data, equipment details, instructions and maintenance books and manuals, spare parts, books and descriptive data shall be in the English language.

SP-13 COMMUNICATIONS WITH THE PURCHASER

Address for all communications for the approval of drawings and other submittals etc., as follows:

THE PURCHASER:

Chief Engineer (Dev) PMU HESCO Hyderabad
B# A-1 HESCO Colony Hussainabad Hyderabad.
Tel: +92-22-9260070 Fax: +92-22-9260525

SP-14 TYPE TESTS

A. All equipment being supplied shall conform to type test as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the type tests as per NTDC latest type test policy attached herewith.

B. The reports for all type tests as per technical specification shall be furnished by the Supplier along with equipment/material drawings. The type tests conducted earlier should have been conducted in any of the STL labs. Or HV & SC Lab Rawat, Pakistan

C. The Type Test reports shall remain valid unless and until.

i. Voltage class has changed
ii. Short Circuit level has changed
iii. The applicable standards have changed.
iv. The design/construction has changed.
v. Manufacturing Facility has changed.

D. The equipment which are not mentioned in latest NTDC type test policy shall be tested as per relevant NTDC specifications.

E. In the event of any discrepancy in the type test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all additional type tests not carried out, same shall be carried out without additional cost implication to the Purchaser as per National Transmission and Dispatch Company Pakistan latest type test policy attached herewith.

F. These type test charges would be considered in bid evaluation. In case Bidder does not indicate charges for any of the type tests, it will be presumed that the particular test has been offered free of charge. Further, in case any Bidder indicates that he shall not carry out a particular test; or any test which is required to be carried out as per SP-14 (D) above, his offer shall be considered incomplete and liable to be rejected.

G. The type testing, in case of award, will be arranged as per National Transmission and Dispatch Company Pakistan's latest Type Test Policy or the relevant NTDC Specification attached herewith in accordance with the provisions of the bidding document without affecting the stipulated delivery schedule.

H. Failure to provide type test certificates with the bid may not result in bid rejection. The Purchaser can ask for test results after bid opening as deemed necessary.

6. Inspections and Tests

Inspections and Tests shall be carried out as per attached Specification.

PART 3 - Contract

Section VIII - General Conditions of Contract

Table of Clauses

Section VIII - General Conditions of Contract

1. Definitions

1.1 The following words and expressions shall have the meanings hereby assigned to them:

(a) **"Bank"** means the World Bank and refers to the International Bank for Reconstruction and Development (IBRD) or the International Development Association (IDA).

(b) **"Contract"** means the Contract Agreement entered into between the Purchaser and the Supplier, together with the Contract Documents referred to therein, including all attachments, appendices, and all documents incorporated by reference therein.

(c) **"Contract Documents"** means the documents listed in the Contract Agreement, including any amendments thereto.

(d) **"Contract Price"** means the price payable to the Supplier as specified in the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

(e) **"Day"** means calendar day.

(f) **"Completion"** means the fulfillment of the Related Services by the Supplier in accordance with the terms and conditions set forth in the Contract.

(g) **"GCC"** means the General Conditions of Contract.

(h) **"Goods"** means all of the commodities, raw material, machinery and equipment, and/or other materials that the Supplier is required to supply to the Purchaser under the Contract.

(i) **"Purchaser's Country"** is the country specified in the **Special Conditions of Contract (SCC).**

(j) **"Purchaser"** means the entity purchasing the Goods and Related Services, as **specified in the SCC.**

(k) **"Related Services"** means the services incidental to the supply of the goods, such as insurance, installation, training and initial maintenance and other such obligations of the Supplier under the Contract.

(l) **"SCC"** means the Special Conditions of Contract.

(m) **"SubSupplier"** means any person, private or government entity, or a combination of the above, to whom any part of

the Goods to be supplied or execution of any part of the Related Services is subcontracted by the Supplier.

(n) **"Supplier"** means the person, private or government entity, or a combination of the above, whose Bid to perform the Contract has been accepted by the Purchaser and is named as such in the Contract Agreement.

(o) **"The Project Site,"** where applicable, means the place named in the **SCC.**

2. Contract Documents

2.1 Subject to the order of precedence set forth in the Contract Agreement, all documents forming the Contract (and all parts thereof) are intended to be correlative, complementary, and mutually explanatory. The Contract Agreement shall be read as a whole.

3. Fraud and Corruption

3.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, as set forth in Appendix 1 to the GCC.

3.2 The Purchaser requires the Supplier to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the Bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee.

4. Interpretation

4.1 If the context so requires it, singular means plural and vice versa.

4.2 Incoterms

(a) Unless inconsistent with any provision of the Contract**,** the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms **specified in the SCC**.

(b) The terms EXW, CIP, FCA, CFR and other similar terms, when used, shall be governed by the rules prescribed in the current edition of Incoterms specified in the **SCC** and published by the International Chamber of Commerce in Paris, France.

4.3 Entire Agreement

The Contract constitutes the entire agreement between the Purchaser and the Supplier and supersedes all communications, negotiations and agreements (whether written or oral) of the parties with respect thereto made prior to the date of Contract.

4.4 Amendment

No amendment or other variation of the Contract shall be valid unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party thereto.

4.5 Nonwaiver

(a) Subject to GCC Sub-Clause 4.5(b) below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

(b) Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

4.6 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

5. Language

5.1 The Contract as well as all correspondence and documents relating to the Contract exchanged by the Supplier and the Purchaser, shall be written in the language specified in the **SCC.** Supporting documents and printed literature that are part of the Contract may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified**,** in which case, for purposes of interpretation of the Contract, this translation shall govern.

5.2 The Supplier shall bear all costs of translation to the governing language and all risks of the accuracy of such translation, for documents provided by the Supplier.

6. Joint Venture, Consortium or Association

6.1 If the Supplier is a joint venture, consortium, or association, all of the parties shall be jointly and severally liable to the Purchaser for the fulfillment of the provisions of the Contract and shall designate one party to act as a leader with authority to bind the joint venture, consortium, or association. The composition or the constitution of the joint venture, consortium, or association shall not be altered without the prior consent of the Purchaser.

7. Eligibility

7.1 The Supplier and its Sub Suppliers shall have the nationality of an eligible country. A Supplier or Sub Supplier shall be deemed to have the nationality of a country if it is a citizen or constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country.

7.2 All Goods and Related Services to be supplied under the Contract and financed by the Bank shall have their origin in Eligible Countries. For the purpose of this Clause, origin means the country where the goods have been grown, mined, cultivated, produced, manufactured, or processed; or through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.

8. Notices

8.1 Any notice given by one party to the other pursuant to the Contract shall be in writing to the address specified in the **SCC.** The term "in writing" means communicated in written form with proof of receipt.

8.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

9. Governing Law

9.1 The Contract shall be governed by and interpreted in accordance with the laws of the Purchaser's Country, unless otherwise specified in the **SCC.**

9.2 Throughout the execution of the Contract, the Supplier shall comply with the import of goods and services prohibitions in the Purchaser's Country when

(a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country; or

9.2 (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's Country prohibits any import of goods from that country or any payments to any country, person, or entity in that country.

10. Settlement of Disputes

10.1 The Purchaser and the Supplier shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

10.2 If, after twenty-eight (28) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the Purchaser or the Supplier may give notice to the other party of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect

of this matter may be commenced unless such notice is given. Any dispute or difference in respect of which a notice of intention to commence arbitration has been given in accordance with this Clause shall be finally settled by arbitration. Arbitration may be commenced prior to or after delivery of the Goods under the Contract. Arbitration proceedings shall be conducted in accordance with the rules of procedure specified in the **SCC.**

10.3 Notwithstanding any reference to arbitration herein,

(a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree; and

(b) the Purchaser shall pay the Supplier any monies due the Supplier.

11. Inspections and Audit by the Bank

11.1 The Supplier shall keep, and shall make all reasonable efforts to cause its Sub Suppliers to keep, accurate and systematic accounts and records in respect of the Goods in such form and details as will clearly identify relevant time changes and costs.

11.2 Pursuant to paragraph 2.2 e. of Appendix 1 to the General Conditions the Supplier shall permit and shall cause its agents (where declared or not), sub Suppliers, sub consultants, service providers, suppliers, and personnel, to permit, the Bank and/or persons appointed by the Bank to inspect the site and/or the accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have such accounts, records and other documents audited by auditors appointed by the Bank. The Supplier's and its Sub Suppliers' and sub consultants' attention is drawn to Sub-Clause 3.1 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).

12. Scope of Supply

12.1 The Goods and Related Services to be supplied shall be as specified in the Schedule of Requirements.

13. Delivery and Documents

13.1 Subject to GCC Sub-Clause 33.1, the Delivery of the Goods and Completion of the Related Services shall be in accordance with the Delivery and Completion Schedule specified in the Schedule of Requirements. The details of shipping and other documents to be furnished by the Supplier are specified in the **SCC.**

14. Supplier's Responsibilities

14.1 The Supplier shall supply all the Goods and Related Services included in the Scope of Supply in accordance with GCC Clause 12, and the Delivery and Completion Schedule, as per GCC Clause 13.

14.2 The Supplier, including its Sub Suppliers, shall not employ or engage forced labor or persons subject to trafficking, as described in GCC Sub-Clauses 14.3 and 14.4.

14.3 Forced labor consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.

14.4 Trafficking in persons is defined as the recruitment, transportation, transfer, harboring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.

14.5 The Supplier, including its Sub Suppliers, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age).

14.6 The Supplier, including its Sub Suppliers, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

14.7 Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work:

(a) with exposure to physical, psychological or sexual abuse;

(b) underground, underwater, working at heights or in confined spaces;

(c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads;

(d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise or vibration damaging to health; or

(e) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer.

14.8 The Supplier shall comply, and shall require its Sub Suppliers if any to comply, with all applicable health and safety regulations, laws, guidelines, and any other requirement stated in the Technical Specifications.

14.9 The Supplier shall comply with additional obligations as **specified in the SCC.**

15. Contract Price

15.1 Prices charged by the Supplier for the Goods supplied and the Related Services performed under the Contract shall not vary from the prices quoted by the Supplier in its Bid, with the exception of any price adjustments authorized in the **SCC.**

16. Terms of Payment

16.1 The Contract Price, including any Advance Payments, if applicable, shall be paid as specified in the **SCC.**

16.2 The Supplier's request for payment shall be made to the Purchaser in writing, accompanied by invoices describing, as appropriate, the Goods delivered and Related Services performed, and by the documents submitted pursuant to GCC Clause 13 and upon fulfillment of all other obligations stipulated in the Contract.

16.3 Payments shall be made promptly by the Purchaser, but in no case later than sixty (60) days after submission of an invoice or request for payment by the Supplier, and after the Purchaser has accepted it.

16.4 The currencies in which payments shall be made to the Supplier under this Contract shall be those in which the Bid price is expressed.

16.5 In the event that the Purchaser fails to pay the Supplier any payment by its due date or within the period set forth in the **SCC,** the Purchaser shall pay to the Supplier interest on the amount of such delayed payment at the rate shown in the **SCC,** for the period of delay until payment has been made in full, whether before or after judgment or arbitrage award.

17. Taxes and Duties

17.1 For goods manufactured outside the Purchaser's Country, the Supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the Purchaser's Country.

17.2 For goods Manufactured within the Purchaser's Country, the Supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted Goods to the Purchaser.

17.3 If any tax exemptions, reductions, allowances or privileges may be available to the Supplier in the Purchaser's Country, the

Purchaser shall use its best efforts to enable the Supplier to benefit from any such tax savings to the maximum allowable extent.

18. Performance Security

18.1 If required as specified in the SCC, the Supplier shall, within twenty-eight (28) days of the notification of contract award, provide a performance security for the performance of the Contract in the amount specified in the **SCC.**

18.2 The proceeds of the Performance Security shall be payable to the Purchaser as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.

18.3 As specified in the SCC, the Performance Security, if required, shall be denominated in the currency(ies) of the Contract, or in a freely convertible currency acceptable to the Purchaser; and shall be in one of the format stipulated by the Purchaser in the SCC, or in another format acceptable to the Purchaser.

18.4 The Performance Security shall be discharged by the Purchaser and returned to the Supplier not later than twenty-eight (28) days following the date of Completion of the Supplier's performance obligations under the Contract, including any warranty obligations, unless specified otherwise in the **SCC.**

19. Copyright

19.1 The copyright in all drawings, documents, and other materials containing data and information furnished to the Purchaser by the Supplier herein shall remain vested in the Supplier, or, if they are furnished to the Purchaser directly or through the Supplier by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party.

20. Confidential Information

20.1 The Purchaser and the Supplier shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Supplier may furnish to its Sub Supplier such documents, data, and other information it receives from the Purchaser to the extent required for the Sub Supplier to perform its work under the Contract, in which event the Supplier shall obtain from such Sub Supplier an undertaking of confidentiality similar to that imposed on the Supplier under GCC Clause 20.

20.2 The Purchaser shall not use such documents, data, and other information received from the Supplier for any purposes unrelated to the contract. Similarly, the Supplier shall not use such documents, data, and other information received from the

Purchaser for any purpose other than the performance of the Contract.

20.3 The obligation of a party under GCC Sub-Clauses 20.1 and 20.2 above, however, shall not apply to information that:

(a) the Purchaser or Supplier need to share with the Bank or other institutions participating in the financing of the Contract;

(b) now or hereafter enters the public domain through no fault of that party;

(c) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party; or

(d) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.

20.4 The above provisions of GCC Clause 20 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Supply or any part thereof.

20.5 The provisions of GCC Clause 20 shall survive completion or termination, for whatever reason, of the Contract.

21. Subcontracting

21.1 The Supplier shall notify the Purchaser in writing of all subcontracts awarded under the Contract if not already specified in the Bid. Notification by the Supplier, for addition of any SubSupplier not named in the Contract, shall also include the SubSupplier's declaration in accordance with Appendix 2 to the GCC- Sexual exploitation and Abuse (SEA) and/or Sexual Harassment (SH) Performance Declaration. Such notification, in the original Bid or later shall not relieve the Supplier from any of its obligations, duties, responsibilities, or liability under the Contract.

21.2 Subcontracts shall comply with the provisions of GCC Clauses 3 and 7.

22. Specifications and Standards

22.1 Technical Specifications and Drawings

(a) The Goods and Related Services supplied under this Contract shall conform to the technical specifications and standards mentioned in Section VI, Schedule of Requirements and, when no applicable standard is mentioned, the standard shall be equivalent or superior to the official standards whose application is appropriate to the Goods' country of origin.

(b) The Supplier shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designed by or on behalf of the Purchaser, by giving a notice of such disclaimer to the Purchaser.

(c) Wherever references are made in the Contract to codes and standards in accordance with which it shall be executed, the edition or the revised version of such codes and standards shall be those specified in the Schedule of Requirements. During Contract execution, any changes in any such codes and standards shall be applied only after approval by the Purchaser and shall be treated in accordance with GCC Clause 33.

23. Packing and Documents

23.1 The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. During transit, the packing shall be sufficient to withstand, without limitation, rough handling and exposure to extreme temperatures, salt and precipitation, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the goods' final destination and the absence of heavy handling facilities at all points in transit.

23.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirements, if any, specified in the SCC, and in any other instructions ordered by the Purchaser.

24. Insurance

24.1 Unless otherwise specified in the **SCC,** the Goods supplied under the Contract shall be fully insured—in a freely convertible currency from an eligible country—against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery, in accordance with the applicable Incoterms or in the manner specified in the **SCC.**

25. Transportation and Incidental Services

25.1 Unless otherwise specified in the **SCC,** responsibility for arranging transportation of the Goods shall be in accordance with the specified Incoterms.

25.2 The Supplier may be required to provide any or all of the following services, including additional services, if any, specified in SCC:

(a) performance or supervision of on-site assembly and/or start-up of the supplied Goods;

(b) furnishing of tools required for assembly and/or maintenance of the supplied Goods;

(c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;

(d) performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Supplier of any warranty obligations under this Contract; and

(e) training of the Purchaser's personnel, at the Supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied Goods.

25.3 Prices charged by the Supplier for incidental services, if not included in the Contract Price for the Goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the Supplier for similar services

26. Inspections and Tests

26.1 The Supplier shall at its own expense and at no cost to the Purchaser carry out all such tests and/or inspections of the Goods and Related Services as are specified in the **SCC.**

26.2 The inspections and tests may be conducted on the premises of the Supplier or its Sub Supplier, at point of delivery, and/or at the Goods' final destination, or in another place in the Purchaser's Country as specified in the **SCC.** Subject to GCC Sub-Clause 26.3, if conducted on the premises of the Supplier or its Sub Supplier, all reasonable facilities and assistance, including access to drawings and production data, shall be furnished to the inspectors at no charge to the Purchaser.

26.3 The Purchaser or its designated representative shall be entitled to attend the tests and/or inspections referred to in GCC Sub-Clause 26.2, provided that the Purchaser bear all of its own costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.

26.4 Whenever the Supplier is ready to carry out any such test and inspection, it shall give a reasonable advance notice, including the place and time, to the Purchaser. The Supplier shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser or its designated representative to attend the test and/or inspection.

26.5 The Purchaser may require the Supplier to carry out any test and/or inspection not required by the Contract but deemed necessary to verify that the characteristics and performance of the Goods comply with the technical specifications codes and

standards under the Contract, provided that the Supplier's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of manufacturing and/or the Supplier's performance of its other obligations under the Contract, due allowance will be made in respect of the Delivery Dates and Completion Dates and the other obligations so affected.

26.6 The Supplier shall provide the Purchaser with a report of the results of any such test and/or inspection.

26.7 The Purchaser may reject any Goods or any part thereof that fail to pass any test and/or inspection or do not conform to the specifications. The Supplier shall either rectify or replace such rejected Goods or parts thereof or make alterations necessary to meet the specifications at no cost to the Purchaser, and shall repeat the test and/or inspection, at no cost to the Purchaser, upon giving a notice pursuant to GCC Sub-Clause 26.4.

26.8 The Supplier agrees that neither the execution of a test and/or inspection of the Goods or any part thereof, nor the attendance by the Purchaser or its representative, nor the issue of any report pursuant to GCC Sub-Clause 26.6, shall release the Supplier from any warranties or other obligations under the Contract.

27. Liquidated Damages

27.1 Except as provided under GCC Clause 32, if the Supplier fails to deliver any or all of the Goods by the Date(s) of delivery or perform the Related Services within the period specified in the Contract, the Purchaser may without prejudice to all its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to the percentage specified in the **SCC** of the delivered price of the delayed Goods or unperformed Services for each week or part thereof of delay until actual delivery or performance, up to a maximum deduction of the percentage specified in those **SCC.** Once the maximum is reached, the Purchaser may terminate the Contract pursuant to GCC Clause 35.

28. Warranty

28.1 The Supplier warrants that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

28.2 Subject to GCC Sub-Clause 22.1(b), the Supplier further warrants that the Goods shall be free from defects arising from any act or omission of the Supplier or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the country of final destination.

28.3 Unless otherwise specified in the **SCC,** the warranty shall remain valid for twelve (12) months after the Goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the **SCC,** or for eighteen (18) months after the date of shipment from the port or place of loading in the country of origin, whichever period concludes earlier.

28.4 The Purchaser shall give notice to the Supplier stating the nature of any such defects together with all available evidence thereof, promptly following the discovery thereof. The Purchaser shall afford all reasonable opportunity for the Supplier to inspect such defects.

28.5 Upon receipt of such notice, the Supplier shall, within the period specified in the **SCC,** expeditiously repair or replace the defective Goods or parts thereof, at no cost to the Purchaser.

28.6 If having been notified, the Supplier fails to remedy the defect within the period specified in the **SCC,** the Purchaser may proceed to take within a reasonable period such remedial action as may be necessary, at the Supplier's risk and expense and without prejudice to any other rights which the Purchaser may have against the Supplier under the Contract.

29. Patent Indemnity

29.1 The Supplier shall, subject to the Purchaser's compliance with GCC Sub-Clause 29.2, indemnify and hold harmless the Purchaser and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney's fees and expenses, which the Purchaser may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract by reason of:

(a) the installation of the Goods by the Supplier or the use of the Goods in the country where the Site is located; and

(b) the sale in any country of the products produced by the Goods.

Such indemnity shall not cover any use of the Goods or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, neither any infringement resulting from the use of the Goods or any part thereof, or any products produced thereby in association or combination with any other equipment, plant, or materials not supplied by the Supplier, pursuant to the Contract.

29.2 If any proceedings are brought or any claim is made against the Purchaser arising out of the matters referred to in GCC Sub-Clause 29.1, the Purchaser shall promptly give the Supplier a notice thereof, and the Supplier may at its own expense and in the Purchaser's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

29.3 If the Supplier fails to notify the Purchaser within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Purchaser shall be free to conduct the same on its own behalf.

29.4 The Purchaser shall, at the Supplier's request, afford all available assistance to the Supplier in conducting such proceedings or claim, and shall be reimbursed by the Supplier for all reasonable expenses incurred in so doing.

29.5 `The Purchaser shall indemnify and hold harmless the Supplier and its employees, officers, and Sub Suppliers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of any nature, including attorney's fees and expenses, which the Supplier may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright, or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Purchaser.

30. Limitation of Liability

30.1 Except in cases of criminal negligence or willful misconduct,

(a) the Supplier shall not be liable to the Purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Supplier to pay liquidated damages to the Purchaser and

(b) the aggregate liability of the Supplier to the Purchaser, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the supplier to indemnify the Purchaser with respect to patent infringement

31. Change in Laws and Regulations

31.1 Unless otherwise specified in the Contract, if after the date of 28 days prior to date of Bid submission, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in the place of the Purchaser's Country where the Site is located (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the Delivery Date and/or the Contract Price, then such Delivery Date and/or Contract Price shall be correspondingly increased or decreased, to the extent that the Supplier has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced cost shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with GCC Clause 15.

32. Force Majeure

32.1 The Supplier shall not be liable for forfeiture of its Performance Security, liquidated damages, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

32.2 For purposes of this Clause, "Force Majeure" means an event or situation beyond the control of the Supplier that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Supplier. Such events may include, but not be limited to, acts of the Purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.

32.3 If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

33. Change Orders and Contract Amendments

33.1 The Purchaser may at any time order the Supplier through notice in accordance GCC Clause 8, to make changes within the general scope of the Contract in any one or more of the following:

(a) drawings, designs, or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the Purchaser;

(b) the method of shipment or packing;

(c) the place of delivery; and

(d) the Related Services to be provided by the Supplier.

33.2 If any such change causes an increase or decrease in the cost of, or the time required for, the Supplier's performance of any provisions under the Contract, an equitable adjustment shall be made in the Contract Price or in the Delivery/Completion Schedule, or both, and the Contract shall accordingly be amended. Any claims by the Supplier for adjustment under this Clause must be asserted within twenty-eight (28) days from the date of the Supplier's receipt of the Purchaser's change order.

33.3 Prices to be charged by the Supplier for any Related Services that might be needed but which were not included in the Contract shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the Supplier for similar services.

33.4 **Value Engineering:** The Supplier may prepare, at its own cost, a value engineering proposal at any time during the performance of the contract. The value engineering proposal shall, at a minimum, include the following;

(a) the proposed change(s), and a description of the difference to the existing contract requirements;

(b) a full cost/benefit analysis of the proposed change(s) including a description and estimate of costs (including life cycle costs) the Purchaser may incur in implementing the value engineering proposal; and

(c) a description of any effect(s) of the change on performance/functionality.

The Purchaser may accept the value engineering proposal if the proposal demonstrates benefits that:

(a) accelerates the delivery period; or

(b) reduces the Contract Price or the life cycle costs to the Purchaser; or

(c) improves the quality, efficiency or sustainability of the Goods; or

(d) yields any other benefits to the Purchaser,

without compromising the necessary functions of the Facilities.

If the value engineering proposal is approved by the Purchaser and results in:

(a) a reduction of the Contract Price; the amount to be paid to the Supplier shall be the percentage specified **in the PCC** of the reduction in the Contract Price; or

(b) an increase in the Contract Price; but results in a reduction in life cycle costs due to any benefit described in (a) to (d) above, the amount to be paid to the Supplier shall be the full increase in the Contract Price.

33.5 Subject to the above, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the parties.

34. Extensions of Time

34.1 If at any time during performance of the Contract, the Supplier or its sub Suppliers should encounter conditions impeding timely delivery of the Goods or completion of Related Services pursuant to GCC Clause 13, the Supplier shall promptly notify the Purchaser in writing of the delay, its likely duration, and its cause. As soon as practicable after receipt of the Supplier's notice, the Purchaser shall evaluate the situation and may at its discretion extend the Supplier's time for performance, in which case the extension shall be ratified by the parties by amendment of the Contract.

34.2 Except in case of Force Majeure, as provided under GCC Clause 32, a delay by the Supplier in the performance of its Delivery and Completion obligations shall render the Supplier liable to the imposition of liquidated damages pursuant to GCC Clause 26, unless an extension of time is agreed upon, pursuant to GCC Sub-Clause 34.1.

35. Termination

35.1 Termination for Default

(a) The Purchaser, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Supplier, may terminate the Contract in whole or in part:

(i) if the Supplier fails to deliver any or all of the Goods within the period specified in the Contract, or within any extension thereof granted by the Purchaser pursuant to GCC Clause 34;

(ii) if the Supplier fails to perform any other obligation under the Contract; or

(iii) if the Supplier, in the judgment of the Purchaser has engaged in Fraud and Corruption, as defined in paragrpah 2.2 a of the Appendix 1 to the GCC, in competing for or in executing the Contract.

(b) In the event the Purchaser terminates the Contract in whole or in part, pursuant to GCC Clause 35.1(a), the Purchaser may procure, upon such terms and in such manner as it deems appropriate, Goods or Related Services similar to

those undelivered or not performed, and the Supplier shall be liable to the Purchaser for any additional costs for such similar Goods or Related Services. However, the Supplier shall continue performance of the Contract to the extent not terminated.

35.2 Termination for Insolvency.

(a) The Purchaser may at any time terminate the Contract by giving notice to the Supplier if the Supplier becomes bankrupt or otherwise insolvent. In such event, termination will be without compensation to the Supplier, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the Purchaser

35.3 Termination for Convenience.

(a) The Purchaser, by notice sent to the Supplier, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Purchaser's convenience, the extent to which performance of the Supplier under the Contract is terminated, and the date upon which such termination becomes effective.

(b) The Goods that are complete and ready for shipment within twenty-eight (28) days after the Supplier's receipt of notice of termination shall be accepted by the Purchaser at the Contract terms and prices. For the remaining Goods, the Purchaser may elect:

(i) to have any portion completed and delivered at the Contract terms and prices; and/or

(ii) to cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and Related Services and for materials and parts previously procured by the Supplier.

36. Assignment

36.1 Neither the Purchaser nor the Supplier shall assign, in whole or in part, their obligations under this Contract, except with prior written consent of the other party.

37. Export Restriction

37.1 Notwithstanding any obligation under the Contract to complete all export formalities, any export restrictions attributable to the Purchaser, to the country of the Purchaser, or to the use of the products/goods, systems or services to be supplied, which arise from trade regulations from a country supplying those products/goods, systems or services, and which substantially impede the Supplier from meeting its obligations under the

Contract, shall release the Supplier from the obligation to provide deliveries or services, always provided, however, that the Supplier can demonstrate to the satisfaction of the Purchaser and of the Bank that it has completed all formalities in a timely manner, including applying for permits, authorizations and licenses necessary for the export of the products/goods, systems or services under the terms of the Contract. Termination of the Contract on this basis shall be for the Purchaser's convenience pursuant to Sub-Clause 35.3.

APPENDIX 1

Fraud and Corruption

(Text in this Appendix shall not be modified)

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants/proposers), consultants, Suppliers and suppliers; any sub-Suppliers, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

a. Defines, for the purposes of this provision, the terms set forth below as follows:

i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v. "obstructive practice" is:

(a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

(b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.

b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-Suppliers, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring miss procurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;

d. Pursuant to the Bank's Anti- Corruption Guidelines and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;[1] (ii) to be a nominated[2] sub-Supplier, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;

e. Requires that a clause be included in bidding/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, Suppliers, and suppliers, and their sub-Suppliers, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect[3] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

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1 For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-Supplier, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

2 A nominated sub-Supplier, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

3 Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

APPENDIX 2
Sexual Exploitation and Abuse (SEA) and/or Sexual Harassment (SH) Performance Declaration for Sub Suppliers*

[The following table shall be filled in by each sub Supplier proposed by the Supplier, that was not named in the Contract]

Sub Supplier's Name: *[insert full name]*

Date: *[insert day, month, year]*
Contract reference *[insert contract reference]*
Page *[insert page number]* of *[insert total number]* pages

SEA and/or SH Declaration
We: ☐ (a) have not been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. ☐ (b) are subject to disqualification by the Bank for non-compliance with SEA/ SH obligations. ☐ (c) had been subject to disqualification by the Bank for non-compliance with SEA/ SH obligations, and were removed from the disqualification list. An arbitral award on the disqualification case has been made in our favor.
[*If (c) above is applicable, attach evidence of an arbitral award reversing the findings on the issues underlying the disqualification.]*
Period of disqualification: From: _____ To: _____

Name of the Sub Supplier_____

Name of the person duly authorized to sign on behalf of the Sub Supplier_____

Title of the person signing on behalf of the Sub Supplier_____

Signature of the person named above_____

Date signed _____ day of _____, _____

Countersignature of authorized representative of the Supplier:
Signature: _____

Date signed _____ day of _____, _____

Section IX - Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement and / or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

GCC 1.1(i)	The Purchaser's Country is: Pakistan
GCC 1.1(j)	The Purchaser is: Hyderabad Electric Supply Company, Pakistan *HESCO*
GCC 1.1(o)	The Project Site(s)/Final Destination(s) is/are: Regional Store HESCO, T.M.Khan Road Hyderabad.
GCC 1.1 (p)	The term **SEA/SH** where used in the Contract has the following meaning: • "**Sexual Exploitation and Abuse" "(SEA)"** means the following: **Sexual Exploitation** is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another. **Sexual Abuse** is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions. • **"Sexual Harassment" "(SH)"** is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by Supplier's personnel with other Supplier's, sub Suppliers' or employer's personnel.
GCC 4.2 (b)	The version edition of Incoterms shall be : Incoterm 2020
GCC 5.1	The language shall be: English

GCC 8.1	For **notices**, the Purchaser's address shall be: Attention: Chief Engineer (Dev) PMU HESCO Hyderabad Address: House No.A-1 HESCO Power Wing Colony Hyderabad. City: Hyderabad ZIP/Postal Code: 71000 Country: Pakistan Telephone: +92-22–9260070 Fax number: +92-22–9260525 E-mail address: i. cedevhesco@gmail.com ii. cepmu@hesco.gov.pk
GCC 9.1	The governing law shall be the laws of: The Islamic Republic of Pakistan
GCC 10.2	The rules of procedure for arbitration proceedings pursuant to GCC Clause 10.2 shall be as follows: ***(a) Contract with foreign Supplier:*** GCC 10.2 (a)—Any dispute, controversy or claim arising out of or relating to this Contract, or breach, termination or invalidity thereof, shall be settled by arbitration in accordance with the UNCITRAL Arbitration Rules as at present in force. ***(b) Contracts with Supplier national of the Purchaser's Country:*** In the case of a dispute between the Purchaser and a Supplier who is a national of the Purchaser's Country, the dispute shall be referred to adjudication or arbitration in accordance with the laws of the Purchaser's Country. The territorial jurisdiction of the litigation shall be the District Head Quarter where the head office of HESCO is located i.e Hyderabad District.
GCC 13.1	Details of Shipping and other Documents to be furnished by the Supplier are a negotiable bill of lading, a non-negotiable sea way bill, an airway bill, a railway consignment note, a road consignment note, insurance certificate, Manufacturer's or Supplier's warranty certificate, inspection certificate issued by nominated inspection agency, Supplier's factory shipping details .

	The above documents shall be received by the Purchaser before arrival of the Goods and, if not received, the Supplier will be responsible for any consequent expenses.
GCC 14.9	Not Applicable
GCC 15.1	The prices charged for the Goods supplied and the related Services performed shall not be adjustable.
GCC 16.1	GCC 16.1—The method and conditions of payment to be made to the Supplier under this Contract shall be as follows: **Payment for Goods supplied from abroad:** Payment of foreign currency portion shall be made in *[insert currency of the Contract Price]* in the following manner: (i) **Advance Payment:** Ten (10) percent of the Contract Price shall be paid within sixty (60) days of signing of the Contract, and upon submission of claim and a bank guarantee for equivalent amount valid until the Goods are delivered and in the form provided in the bidding document or another form acceptable to the Purchaser. (ii) **On Shipment:** Eighty (80) percent of the Contract Price of the Goods shipped shall be paid through irrevocable confirmed letter of credit opened in favor of the Supplier in a bank in its country, upon submission of documents specified in GCC Clause 13. (iii) **On Acceptance:** Ten (10) percent of the Contract Price of Goods received shall be paid within sixty (60) days of receipt of the Goods upon submission of claim supported by the acceptance certificate issued by the Purchaser. Payment of local currency portion shall be made in PKR within sixty (60) days of presentation of claim supported by a certificate from the Purchaser declaring that the Goods have been delivered and that all other contracted Services have been performed. **Payment for Goods and Services supplied from within the Purchaser's Country:** Payment for Goods and Services supplied from within the Purchaser's Country shall be made in PKR, as follows: (i) **Advance Payment:** Ten (10) percent of the Contract Price shall be paid within sixty (60) days of signing of the Contract against a simple receipt and a bank guarantee for the equivalent amount and in the

	form provided in the bidding document or another form acceptable to the Purchaser. (ii) **On Delivery:** Eighty (80) percent of the Contract Price shall be paid on receipt of the Goods and upon submission of the documents specified in GCC Clause 13. (iii) **On Acceptance:** The remaining ten (10) percent of the Contract Price shall be paid to the Supplier within sixty (60) days after the date of the acceptance certificate for the respective delivery issued by the Purchaser.
GCC 16.5	The payment-delay period after which the Purchaser shall pay interest to the supplier shall be Sixty (60) days. The interest rate that shall be applied is: KIBOR + 1% for local currency (i.e. PKR), SOFR + 1% for US $.
GCC 18.1	The amount of Performance Security shall be 10% of the contract price.
GCC 18.3	The Performance Security shall be in the form of demand Guarantee. The Performance security shall be denominated in the currencies of payment of the Contract, in accordance with their portions of the Contract Price.
GCC 18.4	Discharge of the Performance Security shall take place twenty-eight (28) days following the date of Completion of the Supplier's performance obligations under the Contract.

GCC 23.2	The packing, marking and documentation within and outside the packages shall be: **Packing** (a) Packing of the Goods shall be as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit. (b) In case the equipment is shipped in container(s), each unit shall be so packed that it can be safely transported by road/ rail to ultimate destination in the country without disturbing the packing of other items. (c) 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". (d) The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirement, if any, and in any subsequent instructions ordered by the Purchaser. **Identification and Marking** 1. All members, parts, units or components of the Equipment shall be plainly die-indented with a number to identify the member, part, unit or component itself and with a letter to indicate the type of Goods in accordance with approved drawings. The identification marking shall be plainly legible and durable and shall be so located that other member, part, unit or component when in its assembled position does not obscure the number or letter. All the marking on ferrous part or unit shall be made before galvanizing. 2. Each crate, case, box "package" or bundle shall have labels and or tags made from strong waterproof material and marked in indelible and non-fade-able ink securely attached hereto. These labels or tags shall indicate at least the name of the Project, the Consignee and the manufacturer, the type of Goods or component and the quantity it contains so that it can be easily checked upon delivery. A packing list shall be included in each crate or box. 3. Each package delivered under the Contract shall be consecutively numbered and shall also be marked with code number or other identification to be approved by HESCO so that various components of the Goods, which are shipped, disassembled and which may not be interchangeable can be identified, collected and stored at the Site together. Additional information and or colour coding that may reasonably be

	required by HESCO to facilitate identification, shipment to stores or site handling and storage will also be provided. 4. All boxes weighing in excess of 500 kilograms shall be adequately marked for straining and lifting. Whenever necessary the boxes shall be provided with lifting hooks attached by means of vertical rods secured to strong bottom supports. **Container Marking** In addition to labels and marking indicated above all packages, bundles, containers cases or boxes shall be clearly and boldly marked on two opposite sides and on the top and all reels on both sides as follows: Ultimate Consignee: **Deputy. Manager** Regional Store HESCO Site Area, Tando Muhammad Khan Road Hyderabad (Pakistan). Destination _____ Contract No. _____ Name of Project_____ Weight And Dimension_____ Serial Number _____ Inscription "HESCO"
GCC 24.1	The insurance coverage shall be in accordance with Pursuant to GCC , Sub-Clause 24.1, (i) For Goods to be provided from outside the Purchaser Country the Supplier must insure the goods in amount equal to 110% of CIP price of the goods from warehouse to warehouse from supplier's/manufacturer's premises to project site on all risks basis, including war risks and strikes. (ii) For Goods to be provided from within the Purchaser Country, the Supplier must insure the goods in an amount equal to 110% of the EXW price of the goods from warehouse to warehouse from supplier's/manufacturer's premises to project site on all risks basis, including war risks and strikes.
GCC 25.1	The Supplier is required under the Contract to transport the Goods to a specified place of final destination within the Purchaser's Country, defined as the Project Site, transport to such place of destination in the Purchaser's Country, including insurance and storage, as shall be specified in the

	Contract, shall be arranged by the Supplier, and related costs shall be included in the Contract Price.
GCC 25.2	Incidental services to be provided are: **Not Applicable**
GCC 26.1	The inspections and tests shall be carried out as mention in the Technical Specifications.
GCC 26.2	The Inspections and tests shall be conducted on the premises of supplier/manufacturer.
GCC 27.1	The liquidated damage shall be: 0.5% per week. The maximum amount of liquidated damages shall be: 10% of the total contract price.
GCC 28.3	The period of validity of the Warranty shall be 24 months from the date of delivery of last consignment of the material by the supplier. A Warranty to the effect that the goods offered conform exactly to the specifications laid down in this contract and that the goods in question have also been tested and checked prior to delivery & that the goods in question are new and free from all defects, and that in the event of goods being found old or defective or not conforming to the specifications, or not in conformity with the test certificate, the Supplier will be held responsible for all losses and that supplier agree to substitute the unacceptable goods with the acceptable goods at Suppliers risk and cost provided the above mentioned defects / deficiencies are noticed within 18 months from the date of installation / commissioning or 24 months from the date of delivery of last consignment whichever is less. For purposes of the Warranty, the place(s) of final destination(s) shall be: Regional Store HESCO, T.M.Khan Road Hyderabad.
GCC 28.5, GCC 28.6	The period for repair or replacement shall be: 60 days for foreign originated material and 30 days for local originated material from the date of notification by the purchaser of the concurrence of such defects.
GCC 33.4	Not Applicable.

Section X - Contract Forms

Table of Forms

Notification of Intention to Award

[*This Notification of Intention to Award shall be sent to each Bidder that submitted a Bid.*]

[*Send this Notification to the Bidder's Authorized Representative named in the Bidder Information Form*]

For the attention of Bidder's Authorized Representative

Name: *[insert Authorized Representative's name]*

Address: *[insert Authorized Representative's Address]*

Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]*

Email Address: *[insert Authorized Representative's email address]*

[IMPORTANT: insert the date that this Notification is transmitted to Bidders. The Notification must be sent to all Bidders simultaneously. This means on the same date and as close to the same time as possible.]

DATE OF TRANSMISSION: This Notification is sent by: [*email/fax*] on [*date*] (local time)

Notification of Intention to Award

Purchaser: *[insert the name of the Purchaser]*
Project: *[insert name of project]*
Contract title: *[insert the name of the contract]*
Country: *[insert country where RFB is issued]*
Loan No. /Credit No. / Grant No.: *[insert reference number for loan/credit/grant]*
RFB No: *[insert RFB reference number from Procurement Plan]*

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period you may:

a) request a debriefing in relation to the evaluation of your Bid, and/or

b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Bidder

Name:	[*insert name of successful Bidder*]
Address:	[*insert address of the successful Bidder*]
Contract price:	[*insert contract price of the successful Bid*]

2. Other Bidders *[INSTRUCTIONS: insert names of all Bidders that submitted a Bid. If the Bid's price was evaluated include the evaluated price as well as the Bid price as read out.]*

Name of Bidder	Bid price	Evaluated Bid price (if applicable)
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated price*]

3. Reason/s why your Bid was unsuccessful

[INSTRUCTIONS: State the reason/s why <u>this</u> Bidder's Bid was unsuccessful. Do NOT include: (a) a point by point comparison with another Bidder's Bid or (b) information that is marked confidential by the Bidder in its Bid.]

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on [*insert date*] (local time).

You may request a debriefing in relation to the results of the evaluation of your Bid. If you decide to request a debriefing your written request must be made within three (3) Business Days of receipt of this Notification of Intention to Award.

Provide the contract name, reference number, name of the Bidder, contact details; and address the request for debriefing as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Purchaser*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

If your request for a debriefing is received within the 3 Business Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (5) Business Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of the Contract Award Notice.

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

Provide the contract name, reference number, name of the Bidder, contact details; and address the Procurement-related Complaint as follows:

Attention: [*insert full name of person, if applicable*]

Title/position: [*insert title/position*]

Agency: [*insert name of Purchaser*]

Email address: [*insert email address*]

Fax number: [*insert fax number*] ***delete if not used***

At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

Further information:

For more information see the Procurement Regulations for IPF Borrowers (Procurement Regulations)[https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=4005] (Annex III). You should read these provisions before preparing and submitting your complaint. In addition, the World Bank's Guidance "How to make a Procurement-related Complaint" [http://www.worldbank.org/en/projects-operations/products-and-services/brief/procurement-new-framework#framework] provides a useful explanation of the process, as well as a sample letter of complaint.

In summary, there are four essential requirements:

1. You must be an 'interested party'. In this case, that means a Bidder who submitted a Bid in this bidding process, and is the recipient of a Notification of Intention to Award.
2. The complaint can only challenge the decision to award the contract.
3. You must submit the complaint within the period stated above.
4. You must include, in your complaint, all of the information required by the Procurement Regulations (as described in Annex III).

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

The Standstill Period lasts ten (10) Business Days after the date of transmission of this Notification of Intention to Award.

The Standstill Period may be extended as stated in Section 4 above.

If you have any questions regarding this Notification please do not hesitate to contact us.

On behalf of the Purchaser:

Signature: _____

Name: _____

Title/position: _____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form ("Form") is to be completed by the successful Bidder. In case of joint venture, the Bidder must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Bidder is any natural person who ultimately owns or controls the Bidder by meeting one or more of the following conditions:

- *directly or indirectly holding 25% or more of the shares*
- *directly or indirectly holding 25% or more of the voting rights*
- *directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder*

RFB No.: [*insert number of RFB process*]
Request for Bid No.: [*insert identification*]

To: **[*insert complete name of Purchaser*]**

In response to your request in the Letter of Acceptance *dated [insert date of letter of Acceptance]* to furnish additional information on beneficial ownership: *[select one option as applicable and delete the options that are not applicable]*

(i) we hereby provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	Directly or indirectly holding 25% or more of the shares (Yes / No)	Directly or indirectly holding 25 % or more of the Voting Rights (Yes / No)	Directly or indirectly having the right to appoint a majority of the board of the directors or an equivalent governing body of the Bidder (Yes / No)
[include full name (last, middle, first), nationality, country of residence]			

OR

(ii) *We declare that there is no Beneficial Owner meeting one or more of the following conditions:*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder

OR

(iii) We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. [If this option is selected, the Bidder shall provide explanation on why it is unable to identify any Beneficial Owner]

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder]"

Name of the Bidder: *[*insert complete name of the Bidder*]_____

Name of the person duly authorized to sign the Bid on behalf of the Bidder: **[*insert complete name of person duly authorized to sign the Bid*]_____

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]_____

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]_____

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]_____

[*] In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder. In the event that the Bidder is a joint venture, each reference to "Bidder" in the Beneficial Ownership Disclosure Form (including this Introduction thereto) shall be read to refer to the joint venture member.

[**] Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Letter of Acceptance

[use letterhead paper of the Purchaser]

[date]

To: *[name and address of the Supplier]*

Subject: ***Notification of Award Contract No.*** . . . .

This is to notify you that your Bid dated ***[insert date]*** for execution of the ***[insert name of the contract and identification number, as given in the SCC]*** for the Accepted Contract Amount of ***[insert amount in numbers and words and name of currency]***, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish (i) the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms and (ii) the additional information on beneficial ownership in accordance with BDS ITB 45.1 within eight (8) Business days using the Beneficial Ownership Disclosure Form, included in Section X, - Contract Forms, of the Bidding Document.

Authorized Signature: _____
Name and Title of Signatory: _____
Name of Agency: _____

Attachment: Contract Agreement

Contract Agreement

[The successful Bidder shall fill in this form in accordance with the instructions indicated]

THIS AGREEMENT made

the *[insert: **number**]* day of *[insert: **month**]*, *[insert: **year**]*.

BETWEEN

(1) *[insert complete name of Purchaser]*, a *[insert description of type of legal entity, for example, an agency of the Ministry of .... of the Government of {insert name of Country of Purchaser}, or corporation incorporated under the laws of {insert name of Country of Purchaser}]* and having its principal place of business at *[insert address of Purchaser**]*** (hereinafter called "the Purchaser"), of the one part, and

(2) *[insert name of Supplier**]***, a corporation incorporated under the laws of *[insert: country of Supplier**]*** and having its principal place of business at *[insert: address of Supplier]* (hereinafter called "the Supplier"), of the other part:

WHEREAS the Purchaser invited Bids for certain Goods and ancillary services, viz., *[insert brief description of Goods and Services]* and has accepted a Bid by the Supplier for the supply of those Goods and Services

The Purchaser and the Supplier agree as follows:

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

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other contract documents.

   (a) the Letter of Acceptance

   (b) the Letter of Bid

   (c) the Addenda Nos._____ (if any)

   (d) Special Conditions of Contract

   (e) General Conditions of Contract

   (f) the Specification (including Schedule of Requirements and Technical Specifications)

   (g) the completed Schedules (including Price Schedules)

(h) any other document listed in GCC as forming part of the Contract

3. In consideration of the payments to be made by the Purchaser to the Supplier as specified in this Agreement, the Supplier hereby covenants with the Purchaser to provide the Goods and Services and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Purchaser hereby covenants to pay the Supplier in consideration of the provision of the Goods and Services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of *[insert the name of the Contract governing law country]* on the day, month and year indicated above.

For and on behalf of the Purchaser

Signed: *[insert signature]*
in the capacity of *[insert title or other appropriate designation]*
In the presence of *[insert identification of official witness]*

For and on behalf of the Supplier

Signed: *[insert signature of authorized representative(s) of the Supplier]*
in the capacity of *[insert title or other appropriate designation]*
in the presence of *[insert identification of official witness]*

Performance Security

Option 1: (Bank Guarantee)

[The bank, as requested by the successful Bidder, shall fill in this form in accordance with the instructions indicated]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[insert name and Address of Purchaser]*

Date: _ *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _ *[insert name of Supplier, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the supply of _ *[insert name of contract and brief description of Goods and related Services]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (_____) *[insert amount in words]*,[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the …. Day of ……, 2…[2], and any demand for payment under it must be received by us at this office indicated above on or before that date.

---

[1] *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, and denominated either in the currency (ies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

[2] *Insert the date twenty-eight days after the expected completion date as described in GC Clause 18.4. The Purchaser should note that in the event of an extension of this date for completion of the Contract, the Purchaser would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Purchaser might consider adding the following text to the form, at the end of the penultimate*

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months] [one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

Option 2: Performance Bond

By this Bond *[insert name of Principal]* as Principal (hereinafter called "the Supplier") and *[insert name of Surety]* as Surety (hereinafter called "the Surety"), are held and firmly bound unto *[insert name of Purchaser]* as Obligee (hereinafter called "the Supplier") in the amount of *[insert amount in words and figures]*, for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Supplier and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Supplier has entered into a written Agreement with the Purchaser dated the _____ day of _____, 20 ____, for *[name of contract and brief description of Goods and related Services]* in accordance with the documents, plans, specifications, and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinafter referred to as the Contract.

NOW, THEREFORE, the Condition of this Obligation is such that, if the Supplier shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Whenever the Supplier shall be, and declared by the Purchaser to be, in default under the Contract, the Purchaser having performed the Purchaser's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

(1) complete the Contract in accordance with its terms and conditions; or

(2) obtain a Bid or Bids from qualified Bidders for submission to the Purchaser for completing the Contract in accordance with its terms and conditions, and upon determination by the Purchaser and the Surety of the lowest responsive Bidder, arrange for a Contract between such Bidder and Purchaser and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the Balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Contract Price," as used in this paragraph, shall mean the total amount payable by Purchaser to Supplier under the Contract, less the amount properly paid by Purchaser to the Supplier; or

(3) pay the Purchaser the amount required by Purchaser to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

Any suit under this Bond must be instituted not later than twenty-eight (28) days following the date of completion of the Supplier's performance of its obligations under the Contract, including any warranty obligations.

No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Purchaser named herein or the heirs, executors, administrators, successors, and assigns of the Purchaser.

In testimony whereof, the Supplier has hereunto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly attested by the signature of his legal representative, this _____ day of _____ 20 _____.

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

SIGNED ON _____ on behalf of _____

By _____ in the capacity of _____

In the presence of _____

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Insert name and Address of Purchaser]*

Date: *[Insert date of issue]*

ADVANCE PAYMENT GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[insert name of Supplier, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Applicant") has entered into Contract No. *[insert reference number of the contract]* dated *[insert date]* with the Beneficiary, for the execution of *[insert name of contract and brief description of Goods and related Services]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum *[insert amount in figures]* () *[insert amount in words]* is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (_____) *[insert amount in words]*[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:

(a) has used the advance payment for purposes other than toward delivery of Goods; or

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

[1] *The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Purchaser.*

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number *[insert number]* at *[insert name and address of Applicant's bank]*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, has been certified for payment, or on the *[insert day]* day of *[insert month]*, 2 *[insert year]*, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No.758, except that the supporting statement under Article 15(a) is hereby excluded.

.

_____

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

VOLUME- II

SPECIFICATIONS

Procurement of:

Supply of goods 132 KV Supply of goods 132 KV Grid Station & Transmission Line Material

RFB No: ***PK-HESCO-GOODS-EQUIP-ICB/04***

Project: **Electricity Distribution Efficiency Improvement Project**

Purchaser: *Hyderabad Electric Supply Company - HESCO*

Country: *Pakistan*

NATIONAL TRANSMISSION & DESPATCH CO. LTD

Company Secretary

No. NTDC/CS/ 2730-35 Dated: 03 – 02 – 2023

NOTIFICATION

Approval of revised NTDC type test policy

The Board of Directors of National Transmission & Despatch Company Limited (NTDC) in its 240th meeting held on 20.01.2023 against additional agenda item No. 01 has resolved and approved the revised NTDC type test policy (Annex-A).

Azhar Saleem
Company Secretary

Copy to:

1. Managing Director
2. All Deputy Managing Directors
3. Chief Financial Officer
4. General Manager (D&E)

Type Test Requirements of NTDC (Revised Policy)

1 Foreword

1.1 This type test policy will come into effect at once and shall replace the existing type test policy which was issued in 2019.

1.2 This policy shall be applicable to:

a. All Future Procurement
b. All ongoing Tenders
c. Only for those Contracts where approval of equipment/material is not accorded.

1.3 This policy consists of the following:

a. Policy Document
b. Part-I contains the list of approved/STL member laboratories.
c. Part-II deals with the type testing of Grid Station Equipment.
d. Part-III deals with the type testing of Transmission Line Equipment.

1.4 Technical Committee of BOD may issue any amendment to this policy as and when required.

2 Type Test Policy

2.1 The bidder shall offer type tested equipment or if the equipment is not previously type tested, the type tests shall be carried out in line with relevant IEC/other international applicable standard as mentioned in the policy.

2.2 The type test policy covers the scope as given in Part-II and III of this policy. However, the equipment which are not mentioned in this type test policy shall be tested as per relevant NTDC specifications.

2.3 The Type Test reports shall remain valid unless and until.

i. Voltage class has changed
ii. Short Circuit level has changed [1]
iii. The applicable standards have changed.
iv. The design/construction has changed.
v. Manufacturing Facility has changed.

[1] If all other conditions mentioned under Clause 2.3 (i, iii, iv & v) are not violated, the dielectric tests shall be considered acceptable.

2.4 The Test Report shall include complete identification of the equipment and other necessary information as mentioned in the relevant IEC/ other international applicable standard along with drawings stamped by the concerned laboratory.

2.5 The following provisions have been made in this Policy with respect to bidding process:

i. The Bidder shall submit an unconditional Undertaking, duly signed and stamped by bidder and supported by manufacturer(s) accordingly in technical bid, that in case of award of contract if submitted type test reports are not according to NTDC type test policy, he will carry out type tests as per NTDC Type Test Policy within the quoted Bid price and without affecting the delivery/ completion period as mentioned in the Bidding Documents. In case of failure to submit an Undertaking of type tests as per NTDC type test policy along with the bid or in response to post bid clarification:

   a. In supply contract, bid shall be rejected.
   b. In EPC contract, such manufacturer shall not be accepted, and bidder will be bound to replace the same with acceptable manufacturer. In case of noncompliance, the bid shall be rejected.

ii. within 07 days from approval of technical data/ drawings, the contractor shall submit schedule of type testing from laboratory.

iii. After award of contract, the bidder shall be required to perform requisite type tests before delivery of equipment without affecting the delivery/completion period as mentioned in the Bidding Document within the quoted bid price. In case of delay or non-compliance of the said requirement, NTDC reserves the right to cancel the contract agreement including encashment of performance guarantee and initiate the process for blacklisting as per NTDC SOP for blacklisting.

Note:

a) For the purpose of type testing, latest IEC/ other applicable international standard as mentioned in the policy shall be applicable.
b) For service conditions of material/equipment covered in this policy, the relevant NTDC specification shall be applicable.
c) The manufacturers may avail this opportunity for carrying out type tests as per NTDC Policy. NTDC can also nominate its inspectors upon request provided that all such costs shall be borne by the manufacturer.
d) NTDC reserves the right to change all or any parts of the type test policy at any time in the best interest of company.
e) For test grouping, sampling and sequence for the type testing, the procedure/method mentioned in IEC/any other relevant international standard shall be applicable.
f) For type test reports from ISO/IEC 17025 certified laboratories, as permitted in part II & III of the policy, in case of ambiguity in the independent status of the laboratory, the reports shall be acceptable upon providing the certificate from the manufacturer that the laboratory is independent from the manufacturer and offering extended warranty twice of the original.

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407 - Wapda House, Lahore

g) In case of contradiction between NTDC specification & this type test policy, this policy shall prevail.

Abdul Haq
Manager (Tech), HV&SC Lab, Rawat
(Member) _____

Azhar Iqbal
Manager(MP&M) NTDC
(Member) _____

Anees Ahmad
Chief Engineer (T/L Design) NTDC
(Member) _____

Taqi-ud-din
Chief Engineer (P&C) NTDC
(Member) _____

Shahid Shafi Sial
Chief Engineer (SS Design) NTDC
(Convener) _____

Company Secretary (NTDCL)
407 - Wapda House, Lahore

Part-I

(List of Approved/STL member Laboratories)

1. All STL member Laboratories and their subsidiaries/affiliates mentioned on their website www.stl-liaison.org/web/03_members.php

2. Kinectrics Laboratory
   800 Kipling Ave. Etobicoke, ON M8Z 5G5,
   Canada

3. Polotecnico Di Milano
   Plazza Leonardo da Vinci, 32, 20133 Milan
   Italy

4. EGU HV Laboratory A.S
   Podnikatelska 267 190 11 Prague 9, Bechovice
   Czech Republic

5. High Voltage and Short Circuit (HV&SC) Laboratory
   Rawat, Islamabad, Pakistan

6. IREQ, Canada

7. CRIEPI, JAPAN

8. TUV Labs, Italy

Part-II
Grid Station Equipment

1. This part contains the type testing requirements relating to the Grid Station Equipment.

2. The Equipment / material covered under this policy is mentioned hereunder:
   a. Circuit Breaker
   b. Disconnector
   c. Inductive Voltage Transformer/Capacitive Voltage Transformer/CCVT
   d. Current Transformer
   e. Bushings (Transformers, Shunt Reactors & SF_6 to Air (GIS))
   f. Gas Insulated Switchgear (GIS)
   g. Surge Arrester
   h. Post Insulators
   i. Hardware (Connectors and Strings assemblies)

3. The type test to be performed on the above equipment from **Laboratories as per Part-I** of this policy are mentioned below:

Sr. #	Equipment Name	Test to be performed
01	**Circuit Breaker (IEC 62271-100)**	i. Dielectric Tests ii. Temperature-rise Tests iii. Short-time withstand current and peak withstand current tests iv. Short circuit current making and breaking tests
02	**Disconnectors, Earth Switch and Fast Earth Switch (IEC 62271-102)**	i. Dielectric Tests ii. Continuous Current Tests iii. Short-time withstand current and peak withstand current tests
03a	**Inductive Voltage Transformer (IVT) (IEC 61869-1 & 61869-3)**	i. Temperature-rise test ii. Impulse voltage withstand test on primary terminals iii. Wet test for outdoor type transformers iv. Chopped impulse voltage withstand test on primary terminals v. Short circuit withstand capability test
03b	**Capacitive Voltage Transformer (CVT) / CCVT (IEC 61869-1 & 61869-5)**	i. Temperature-rise test ii. Chopped impulse test iii. Impulse voltage withstand test on primary terminals iv. Wet test for outdoor type transformers v. Short circuit withstand capability test
04	**Current Transformer (CT) (IEC 61869-1 & 61869-2)**	i. Temperature-rise test ii. Impulse voltage withstand test on primary terminals iii. Wet test for outdoor type transformers vi. Chopped impulse voltage withstand test on primary terminals vii. Short-time current tests

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Sr. #	Equipment Name	Test to be performed
05	**Bushings (Transformer, Shunt Reactor, SF_6 to Air(GIS))** **(IEC 60137)**	i. Wet power-frequency voltage withstand test ii. Long duration power frequency voltage withstand test (Ur≥170kV) iii. Lightning impulse voltage withstand test. iv. Wet switching impulse voltage withstand test ((Ur≥300kV) v. Temperature rise test. vi. Verification of thermal short-time current withstand (if required)
06	**Gas Insulated Switchgear (GIS)** **(IEC 62271-203)**	i. Tests to verify the insulation level of the equipment and dielectric tests on auxiliary circuits ii. Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit iii. Tests to prove the rated peak and the rated short-time withstand current iv. Tests to verify the making and breaking capacity of the included switching devices
09a	**Connectors (NEMA CC1 & ANSI 119.4)**	i. Heat cycle Test ii. RIV and Corona Tests
09b	**String Assemblies (Tension and Suspensions) (NTDC spec P-Draft and relevant international standards)**	i. Heat Cycle Test (Only for Tension clamp of Tension Assembly if its current carrying device) ii. Corona Test

4. All other type tests not mentioned in point-3 above but are required as per relevant IEC/international standard, may be performed as under:

Sr. #	Equipment Name	Test to be performed	Requirement
01	**Circuit Breaker**	All other type tests not mentioned in point-3 above but are required as per IEC 62271-100	i. Any Independent laboratory accredited by ISO/IEC 17025 ii. Any laboratory as per Part-I iii. Inspection reports issued by any STL Laboratory
02	**Disconnectors, Earth Switch and Fast Earth Switch**	All other type tests not mentioned in point-3 above but are required as per IEC 62271-102	
03a	**Inductive Voltage Transformer (IVT)**	All other type tests not mentioned in point-3 above but are required as per IEC 61869-1 & 61869-3	
03b	**Capacitive Voltage Transformer (CVT) / CCVT**	All other type tests not mentioned in point-3 above but are required as per IEC 61869-1 & 61869-5	
04	**Current Transformer (CT)**	All other type tests not mentioned in point-3 above but are required as per IEC 61869-1 & 61869-2	

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407 - Wapda House, Lahore

Sr. #	Equipment Name	Test to be performed	Requirement
05	**Bushings [2] (Transformer, Shunt Reactor, SF_6 to Air(GIS))**	All other type tests not mentioned in point-3 above but are required as per IEC 60137	
06	**Gas Insulated Switchgear (GIS)[3]**	All other type tests not mentioned in point-3 above but are required as per IEC 62271-203	
07	**Surge Arrester**	All type tests as per IEC 60099-4	
08	**Post Insulators (PI)**	All type tests as per IEC 60168 & 60273.	
09a	**Connectors**	All other type tests not mentioned in point-3 above but are required as per List in Annex-A.	
09b	**String Assemblies**	All other type tests not mentioned in point-3 above but are required as per List in Annex-A.	

Note: In case some tests are categorized as special test in the IEC/relevant international standard while the same are mentioned under type tests in NTDC relevant specification, the same may be performed as per requirement mentioned above.

5. If the offered Circuit Breaker or Disconnector has different continuous current rating than that of the type tested one, then only Temperature rise / continuous current test shall be re-performed from either of the following, provided that the type test reports do not violate the criteria as mentioned under clause 2(3) of this policy:

   i. Any Independent laboratory accredited by ISO/IEC 17025
   ii. Any laboratory as per Part-I
   iii. Inspection report issued by any STL Laboratory

6. If the offered instrument transformer (IVT, CVT/CCVT or CT) has different ratio, VA burden, type of cores (protection & metering) or number of cores from the type tested one[4], then only Temperature rise and accuracy tests shall be re-performed from either of the following, provided that the type test reports do not violate the criteria mentioned under Clause 2.3 of this policy:

   i. Any Independent laboratory accredited by ISO/IEC 17025
   ii. Any laboratory as per Part-I

[2] Transformer, Shunt Reactor and SF_6 Bushings shall either be from M/s Trench Hefley (France/ Switzerland); M/s Passoni & Villa Italy; M/s F&G Germany & M/s ABB Sweden which have proven performance in NTDC system or pre-type tested bushings from an equivalent manufacturer duly tested in accordance with this policy.

[3] Apart from the tests mentioned in IEC for GIS, the following major equipment of GIS shall be type tested in accordance with relevant IEC standards and this policy:

a) Instrument Transformer b) Circuit Breaker c) Disconnector, Earthing Switch and Fast Earthing Switch

[4] The number of cores for the type tested current transformer shall be higher or equal than the offered current transformer.

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iii. Inspection reports issued by any STL Laboratory

7. Chief Engineer (SS Design) NTDC shall be sole judge for the interpretation / applicability for this policy relating to the equipment / material mentioned under Part-II.

8. Chief Engineer (SS Design) NTDC may issue any clarification as and when required relating to Part-II of this policy.

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Part-III
Transmission Line Equipment

1. This part contains the type testing requirements relating to the Transmission Line Equipment.

2. The Equipment / material covered under this policy is mentioned hereunder:
   a. Conductor
   b. Hardware and accessories
   c. Spacer dampers
   d. Stock Bridge Vibration Dampers
   e. Insulators (Toughened Glass/Porcelain/Non-Ceramic Composite)
   f. RTV Coating Material
   g. OPGW
   h. FOC

3. Chief Engineer (TL Design) NTDC shall be the sole judge for the interpretation / applicability for this policy relating to the equipment / material mentioned under Part-III.

4. Chief Engineer (TL Design) NTDC may issue any clarification as and when required relating to Pat-III of this policy.

5. The type tests to be performed on the above equipment from **Labs as per Part-I** of this policy, or otherwise as mentioned against each test, are given in table below:

6. Visual examination, dimensional check and material verification, etc. of the samples to be tested shall be carried out and made part of test report before conducting each of the type test.

S. #	Equipment Name	Tests to be performed		Relevant Standard	Testing Labs
1	**Conductor**	i.	Stress – Strain Test/Stress – Strain Curves	NTDC Specification & relevant IEC/ any other International Standards mentioned in NTDC Specification. IEC 61089.	a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		ii.	Joints in Aluminum Alloy/Aluminum Wires		
		iii.	Ultimate Tensile Strength and Longitudinal Smoothness Test		
2	**Porcelain/ Glass Disc Insulator**	i.	Dry Power Frequency Withstand Voltage Test	NTDC Specification & relevant IEC/ any other International Standards mentioned in	a. Any lab as mentioned in Part-I.
		ii.	Wet Power Frequency Withstand Voltage Test		
		iii.	Dry Lightning Impulse Withstand Voltage Test		

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S. #	Equipment Name	Tests to be performed		Relevant Standard	Testing Labs
		iv.	Radio Interference Voltage (RIV) test	NTDC Specification. IEC 60383, IEC 60437, IEC 61211, IEC 61467, IEC 60507	
		v.	Thermal-Mechanical Performance test		
		vi.	Steep Wave Front Impulse test		
		vii.	Power Arc test (Short String)		
		viii.	Combined Mechanical and Electrical Strength Test		
		ix.	Residual Strength test		a. Any lab as mentioned in Part-I. b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		x.	Impact test		
		xi.	Artificial Pollution Performance test		
3	**Non-Ceramic Composite Insulator Units**	i.	**Tests on interfaces and connections of end fittings:** a) Sudden load release pre-stressing b) Thermal-mechanical pre-stressing c) Water immersion pre-stressing d) Verification tests i. Visual Examination ii. Steep-front impulse voltage test iii. Dry power-frequency voltage test	NTDC Specification & relevant IEC/ any other International Standards mentioned in NTDC Specification. IEC 61109, IEC 62217, IEC 61467, IEC 60507	a. Any lab as mentioned in Part-I
		ii.	**Tests on shed and housing material:** a) Accelerated weathering test b) Tracking and erosion test		a. Any lab as mentioned in Part-I
			c) Artificial Pollution test d) Flammability test e) Hardness test		a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's
		iii.	**Tests on core material:** i. Dye penetration test		

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S. #	Equipment Name	Tests to be performed		Relevant Standard	Testing Labs
					Lab under witness of STL Lab
			ii. Water diffusion test		a. Any lab as mentioned in Part-I; b. Tests at manufacturer's Lab under witness of STL Lab
		iv.	**Assembled core-load time test:** a) Determination of the average failing load of the core of the assembled insulator b) Verification of the 96 h withstand load c) Control of the slope of the strength-time curve of the insulator		
		v.	Damage limit proof test and test of the tightness of the interface between end fittings and insulator housing		
		vi.	High pressure water withstand test		
		vii.	Brittle fracture resistance test		
		viii.	Torsional load test		
		ix.	Grading device test		
		x.	Recovery of hydrophobicity test		
		xi.	Artificial Pollution Performance Test		
4	**Complete Hardware String with fittings including insulators for Composite /Porcelain/ Glass Disc Insulators**	i.	Wet Power Frequency test	NTDC Specification & relevant IEC/ any other International Standards mentioned in NTDC Specification. IEC 60383, IEC 60060-1, IEC 61109, IEC 61467, IEC 61284	a. Any lab as mentioned in Part-I;
		ii.	Dry Lightning Impulse Withstand Voltage test		
		iii.	Wet Switching Impulse Withstand Voltage test (for voltages ≥500kV)		
		iv.	Power Arc test		
		v.	Corona and RIV test		
		vi.	Voltage Distribution Test		
		vii.	Mechanical Strength test		
5	**Conductor/ OPGW/ Shield wire Hardware & Accessories**	i.	Heat Cycle test	NTDC Specification & relevant IEC/ any other International Standards mentioned in	a. Any lab as mentioned in Part-I;
		ii.	Magnetic Loss test		
		iii.	Fault Current Test		
		iv.	Corona & RIV Test		
		v.	Power Arc Test		
		vi.	Galvanization test		

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S. #	Equipment Name	Tests to be performed		Relevant Standard	Testing Labs
		vii.	Resistance to Conductor/ OPGW/ Shield wire Slippage test	NTDC Specification. IEC 61284	a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		viii.	Mechanical test on complete string		
		ix.	Tensile Tests on individual hardware items		
6	**RTV Coating Material**	i.	Inclined Plane Tracking & Erosion Test	NTDC Specification & relevant IEC/ any other International Standards mentioned in NTDC Specification. IEC 60587, IEC 61109, IEC 60507, IEC TS 62073	a. Any lab as mentioned in Part-I
		ii.	Accelerated Weathering Test (1000 Hours)		
		iii.	Hydrophobicity Recovery by Corona Test Method		
		iv.	Dry Arc Resistance		
		v.	Dielectric Strength Test		
		vi.	Volume & Surface Resistivity Test		a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		vii.	Dissipation Factor Test		
		viii.	Artificial Pollution Test by Salt Fog Method		
		ix.	Angle of Hydrophobicity		
7	**Spacer Damper (Twin, Triple, Quad)**	i.	Corona & RIV Test	NTDC Specification & relevant IEC/ any other International Standards mentioned in NTDC Specification. IEC 61854	a. Any lab as mentioned in Part-I;
		ii.	Simulated Short Circuit Current Test		
		iii.	Flexibility Test		
		iv.	Energy Absorbing Test		
		v.	Simulated Oscillation Fatigue Test		
		vi.	Conical Fatigue Test		
		vii.	Characterization of Elastic and Damping Properties		
		viii.	Damping studies/ verification of vibration behavior by Computer Program		
		ix.	Galvanization		a. Any lab as mentioned in Part-I;
		x.	Clamp Slippage Test • Longitudinal Slip • Torsional Slip		

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S. #	Equipment Name	Tests to be performed		Relevant Standard	Testing Labs
		xi.	Bolt Torque Test		b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		xii.	Electrical Resistance Test		
		xiii.	**Elastomer Tests:** a) Temperature endurance test b) Temperature sensitivity test		a. Any lab as mentioned in Part-I;
			c) Specific Gravity and Density Test d) Shore A Hardness Test e) Electrical Resistance Test f) Ultraviolet Resistance Test g) Ozone Resistance Test h) Tension and Elongation Test i) Tear Resistance Test j) Compression Set at 70h, 20°C-100°C-0°C k) Rebound Resilience at 20°C-100°C-0°C l) Air-Oven Deterioration Test 72h, 70°C m) Deterioration in Oils 72h, 70°C n) Water Immersion Test o) Abrasion test		a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
8	**Stockbridge Vibration Damper (for Conductor, Shield wire & OPGW)**	i.	Corona & RIV Test *(only on SB Vibration Dampers for HV conductor)*	NTDC Specification & relevant IEC/ any other International Standards mentioned in NTDC Specification. IEC 61897	a. Any lab as mentioned in Part-I;
		ii.	Damper Performance Tests, which include the below: a. Damper Characteristic Test b. Damper Effectiveness Evaluation c. Verification of Vibration Behavior by Computer Program / Damping Studies		
		iii.	Vertical Fatigue Test		
		iv.	Galvanization		
		v.	Clamp Slippage Test		

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S. #	Equipment Name	Tests to be performed		Relevant Standard	Testing Labs
		vi.	Bolt Torque Test		a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		vii.	Attachment of Weights to Messenger Cable Test		
		viii.	Attachment of Clamp to Messenger Cable Test		
9	**OPGW (Optical Fiber Ground Wire)**	i.	Performance Tests	IEEE-1138-2009 or Equivalent IEC Standards	a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		ii.	Electrical tests		
		iii.	Mechanical tests		
		iv.	Environment test		
10	**FOC (Fiber Optic Cable)**	i.	Performance Test	IEEE-1138-2009 ITU-TG 652 D ASTM B398 B398 M, B415 or Equivalent IEC Standards	a. Any lab as mentioned in Part-I; b. Any Independent lab accredited by ISO/IEC 17025; c. Tests at manufacturer's Lab under witness of STL Lab
		ii.	Electrical tests		
		iii.	Mechanical tests		
		iv.	Environment test		

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Annex-A

Type Tests for Grid Station Hardware

1. Connectors (NEMA CC1 & ANSI 119.4)

i. Heat cycle Test
ii. RIV and Corona Tests
iii. Mechanical Composition Test
iv. Tensile Strength Test
v. Elongation Test
vi. Brinell Hardness Test
vii. Cantilever Test
viii. Corrosion Test
ix. Mechanical Oscillation Test (*applicable on multi-angular connectors only*)
x. Electrical Resistance Test
xi. Temperature Rise Test
xii. Tightening Torque Test

2. String Assemblies (Tension and Suspensions)

(NTDC spec P-Draft and relevant international standards)

iii. Heat Cycle Test (Only for Tension clamp of Tension Assembly if its current carrying device)
iv. Corona Test
v. Mechanical Test
vi. Resistance to Conductor Slippage Test
vii. Resistance Test (only for Tension clamp of Tension Assembly)

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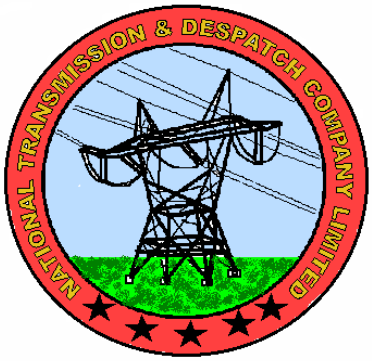

SF6 CIRCUIT BREAKERS 145kV, 72.5kV AND 36kV

DESIGN DEPARTMENT NTDC

C O N T E N T S

PRINTING HISTORY

First Edition	1983
Second Edition	1995
Third Edition	2010

NTDC SPECIFICATION P-193:2010

SF6 CIRCUIT BREAKERS 145 kV, 72.5 kV AND 36 kV.

0.0 FOREWORD

0.1 This specification has been prepared by Standards & Research Directorate of the Design Department NTDC. This third edition cancels and replaces the editions published in 1983 & 1995 and its amendments.

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

0.3 This specification is subject to revision as and when required by S&R directorate of Design NTDC only. No other department is authorized to make/issue amendment in the said specification.

1.0 SCOPE

1.1 This specification is applicable to alternating current live tank 3-pole SF6 circuit breaker alongwith steel supporting structures, grounding bolts, terminal heads and connector for 600mm^2 aluminium conductor for outdoor installations and for operation on 3-phase system having voltages of 145 kV, 72.5 kV and 36 kV.

2.0 REFERENCE STANDARDS

2.1 The circuit breakers shall generally be designed, constructed and tested in accordance with the International Electro-technical commission publication 62271-100 "High Voltage Alternating Current Circuit Breakers" amended to-date.

2.2 The definitions given in the IEC Publication 62271-100 shall apply herein.

2.3 In case the requirements laid down herein differ from those given in the IEC Publication in any particular aspect, the requirements listed herein shall prevail.

3.0 DEFINITIONS

For the purpose of this International Standard, the definitions of IEC 62271-100 shall apply. Some of them are recalled here for ease of reference.

3.1 Out-of-Phase Conditions

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

3.2 **Short-Line Fault (SLF)**

Short-circuit on an overhead line at a short, but significant, distance from the terminals of the circuit-breaker.

3.3 **External Insulation**

Distance in air and the surfaces in contact with open air of solid insulation of the equipment, which are subject to dielectric stresses and to the effects of atmospheric and other external conditions such as pollution, humidity, vermin, etc.

3.4 **Internal Insulation**

Internal solid, liquid or gaseous parts of the insulation of equipment which are protected from the effects of atmospheric and other external conditions.

3.5 **Self-Restoring Insulation**

Insulation which completely recovers its insulating properties after a disruptive discharge.

3.6 **Non-Self Restoring Insulation**

Insulation which loses its insulating properties, or does not recover them completely, after a disruptive discharge.

3.7 **Disruptive Discharge**

Phenomenon associated with the failure of insulation under electric stress, in which the discharge completely bridges the insulation under test, reducing the voltage between the electrodes to zero or nearly to zero.

3.8 **Restrike Performance**

Expected probability of restrike during capacitive current interruption as demonstrated by specified type tests.

3.9 **Circuit-Breaker Class E1**

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

3.10 **Circuit-Breaker Class C2**

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

3.11 **Circuit-Breaker Class M2**

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

3.12 **Circuit-Breaker Class S2**

Circuit breaker intended to be used in a line system or in a cable system with direct connection (without cable) to overhead lines.

3.13 **Terminal Head**

Component provided for the connection of a device to external connectors.

3.14 **Connector**

Component provided for the connection of terminal head to the external conductor.

3.15 **Making (or Breaking) Unit**

Part of a circuit-breaker which in itself acts as a circuit-breaker and which, in series with one or more identical and simultaneously operated making or breaking units, forms the complete circuit-breaker.

3.16 **MODULE**

Assembly which generally comprises making or breaking units, post-insulators and mechanical parts and which is mechanically and electrically connected to other identical assemblies to form a pole of a circuit breaker.

3.17 **Stored Energy Operation**

Operation by means of energy stored in the mechanism itself prior to the switching operation and sufficient to complete the specified operating sequence under predetermined conditions.

3.18 **Making-Current Release**

Release which permits a circuit-breaker to open, without any intentional time delay, during a closing operation, if the making current exceeds a predetermined value, and which is rendered inoperative when the circuit-breaker is in the closed position.

3.19 **Prospective Peak Current**

Peak value of the first major loop of the prospective current during the transient period following initiation.

3.20 **Peak Current**

Peak value of the first major loop of current during the transient period following initiation.

3.21 **(Peak) Making Current**

Peak value of the first major loop of the current in a pole of a circuit-breaker during the transient period following the initiation of current during a making operation.

3.22 **Critical (Breaking) Current**

Value of breaking current, less than rated short-circuit breaking current, at which the arcing time is a maximum and is significantly longer than at the rated short-circuit breaking current. It will be assumed that this is the case if the minimum arcing times in any of the test-duties T10, T30 or T60 is one half-cycle or more longer than the minimum arcing times in the adjacent test-duties.

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

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

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

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

3.25 **Capacitor Bank Breaking Capacity**

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

3.26 **Capacitor Bank Inrush Making Capacity**

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

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

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

3.28 **Opening Time**

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

b) For a self-tripping circuit-breaker, the opening time is the interval of time between the instant at which, the circuit-breaker being in the closed position, the current in the main circuit reaches the operating value of the over-current release and the instant when the arcing contacts have separated in all poles.

3.29 **Arcing Time (of a multi pole switching device)**

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

3.30 **Break Time**

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

3.31 **Closing Time**

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

3.32 **Make Time**

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

3.33 **Pre-Arcing Time**

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

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

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

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

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

3.36 **Re-closing Time**

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

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

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

3.38 **Close-Open Time**

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

3.39 **Make-Break Time**

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

3.40 **Pre-Insertion Time**

Interval of time during a closing operation in any one pole between the instant of contact touch in the closing resistor element and the instant of contact touch in the main breaking unit of that pole.

3.41 **Minimum Trip Duration**

Minimum time the auxiliary power is applied to the opening release to ensure complete opening of the circuit-breaker.

3.42 **Minimum Close Duration**

Minimum time the auxiliary power is applied to the closing device to ensure complete closing of the circuit-breaker.

3.43 **Normal Current**

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

3.44 **Peak Factor (of the line transient voltage)**

Ratio between the maximum excursion and the initial value of the line transient voltage to earth of a phase of an overhead line after the breaking of a short-line fault current.

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

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

3.46 **Amplitude Factor**

Ratio between the maximum excursion of the transient recovery voltage to the crest value of the power frequency recovery voltage.

3.47 **Minimum Functional Pressure for Operation**

Pressure, referred to the standard atmospheric air conditions of +20 °C and 101.3 kPa, which may be expressed in relative or absolute terms, at which and above which rated characteristics of a circuit-breaker are maintained and at which a replenishment of the operating device becomes necessary. This pressure is often designated as interlocking pressure.

3.48 **Minimum Clearing Time**

Sum of the minimum operating time, minimum relay time (0.5 cycle) and the minimum arcing time at current interruption after the minor loop of the first pole to clear, during test duty T-100a, as declared by the manufacturer.

4.0 SERVICE CONDITIONS

The circuit breakers and all accessories shall be suitable for satisfactory operation under the following service conditions:-

4.1 Climatic Conditions

4.1.1 Ambient Temperature

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

4.1.2 Relative Humidity

The relative humidity may range from 0 to 100 percent. The maximum value of the ambient temperature and humidity, however, do not occur simultaneously. During the monsoons, high humidity may persist for many days at a time along with temperatures ranging from 30°C to 40°C.

4.2 Altitude

The circuit breakers shall be suitable for installation upto 1000 m above sea level.

4.3 Atmospheric Conditions

It may be assumed that the air is not normally heavily polluted by dust, smoke, aggressive gases, vapours or salt spray. However, at certain times of the year severe dust storms may be experienced.

4.4 Wind Load

The maximum wind load shall be taken as 122 kg/sq. m. (corresponding to wind speed of 44.2 m/s).

4.5 Supply System

The circuit breakers shall be suitable for installation in 132 kV, 66 kV and 33 kV 3-phase A.C. supply system of the following characteristics:

Rated Voltage	145 kV	72.5 kV	36 kV
Nominal Voltage	132 kV	66 kV	33 kV
Frequency	50 Hz	50 Hz	50 Hz

4.6 **Control and Auxiliary Voltage.**

The nominal control and auxiliary supply voltages shall have the following values:

D.C. Voltage	110 V or 220 V as applicable
A.C. Voltage	240 V single phase and 415 V three-phase, 50 Hz

5.0 **RATINGS AND CHARACTERISTICS**

5.1 The circuit breakers and their accessories shall be so designed as to comply with the following ratings, characteristics and to meet all test requirements laid down herein with respect to insulation strength, current carrying capacity, making and breaking currents and mechanical & electrical operations etc.

	Description			
i.	Nominal Voltage (kV)	132	66	33
ii.	Rated Voltage, U_r (kV)	145	72.5	36
iii.	Class w.r.t. Mechanical Operation	M2	M2	M2
iv.	Class w.r.t. Electrical Endurance	E1	E1	E2
v.	Class w.r.t. Capacitive Current Breaking	C2	C2	C2
vi.	Class w.r.t. Connection to overhead line	S2	S2	S2
vii.	Rated insulation level:			
	a. Lightning impulse Withstand voltage (kV)			
	i) Phase to Phase	650	325	170
	ii) Phase to Earth	650	325	170
	b. One minute power frequency withstand voltage (kV)			
	i) Phase to Phase	275	140	70
	ii) Phase to Earth	275	140	70
viii.	Rated frequency (Hz)	50	50	50
ix.	Rated normal current at 50^{o}C Ambient Temperature (A)	2000	1250	630
x.	Rated short circuit breaking current (kA)	40	25	25
xi.	Rated short circuit making current (kA)	100	63	63
xii.	Rated duration of short-circuit (Sec.)	3	3	3
xiii.	First pole to clear factor	1.5	1.5	1.5
xiv.	Initial transient recovery voltage (kV)	As Per IEC 62271-100		

xv.	Rated transient recovery voltage (TRV) for Terminal faults. (kV)	As Per IEC 62271-100		
xvi.	Rated TRV of the supply circuit for short-line faults(kV)	As Per IEC 62271-100		
xvii.	Rated TRV for out of phase breaking (kV)	As Per IEC 62271-100		
xviii.	Single Capacitor Bank breaking current (A)	As Per IEC 62271-100		
xix.	Rated back to back capacitor bank breaking Current (A)	As Per IEC 62271-100		
xx.	Rated line charging breaking current (A)	As Per IEC 62271-100		
xxi.	Rated out of phase breaking current (kA)	As Per IEC 62271-100		
xxii.	Rated cable charging breaking current (A)	As Per IEC 62271-100		
xxiii.	Rated operating sequence	0-0.3 Sec-CO-3min-CO		
xxiv.	Rated capacitor bank inrush making current (kA)	As Per IEC 62271-100		
xxv.	Rated Short time withstand current (kA)	40	25	25
xxvi.	Rated peak withstand current (kA)	100	63	63
xxvii.	Rated D.C. voltage (V)	110	110	110
xxviii.	Rated D.C. time constant (ms)	45	45	45
xxvix.	Total max. break time for 0 to 100 percent of the rated breaking current (ms)	60	100	100
xxx.	Rated dead time (ms Max.)	300	300	300
xxxi.	Rated opening time (ms Max..)	30	30	30
xxxii.	Max. Radio Interference Level $1.1U_r/\sqrt{3}$ (RIV) (µV)	≤2500	-	-
xxxiii	No. of Mechanical switching operations		10000	
xxxiv.	No. of switching operations at:			
	i) 100% short circuit breaking current		20	
	ii) 60% short circuit breaking current		50	
	iii) 30% short circuit breaking current		200	
	iv) 10% short circuit breaking current		4000	
	v) Max. continuous current carrying capacity		6000	

6.0 GENERAL PERFORMANCE REQUIREMENTS

6.1 The circuit breakers shall be single pressure sulphur hexafluoride (SF6) three pole outdoor type with self contained power operated spring charged operating mechanism. The performance requirements include high breaking capacity, low switching over-voltages, re-strike free capacitive switching, high operational reliability and low maintenance and suitable to withstand the seismic stress/magnitude according to Richer-scale $\geq$ 7 (horizontal acceleration up to 5m/s² (0.5g) for safety of equipment under heavy earth quake conditions.

6.2 The circuit breakers shall suitable for automatic tripping and automatic reclosing and complete with safety interlocks and all necessary accessories to make a complete operating unit. The circuit breakers shall be suitable for single shot, 3-pole rapid auto re-closing. For three pole operation, the poles of the breaker shall be electrically as well as mechanically coupled. The quality of SF6 gas shall conform to relevant IEC standard.

6.3 The circuit breakers shall be capable of breaking any current from zero to its rated breaking current at any voltage upto the rated voltage in a predominantly resistive, inductive and capacitive circuit. The total break time at all currents less than the rated current shall not exceed the maximum breaking time. No restrikes at the main contacts shall be permitted under any operating duty.

6.4 The circuit breakers shall be capable of switching covered by transients over or under voltage and/or over-currents in the system i.e. switching the no load currents of power transformer, switching of shunt capacitor banks and the charging current of overhead lines/ cables up to values indicated in IEC 62271-100. The switching unit enables synchronisation of the switching in both closing & opening conditions. The switching over voltage to earth, measured at the breaker terminals, shall not exceed 2.5 times the maximum rated voltage to earth. No re-strikes at the main contacts shall be permitted under these conditions.

6.5 The circuit breakers shall be capable of breaking the rated out of phase interruption of current upto 25% of the rated short circuit breaking current and rated out of phase making current shall be the crest value of the rated out of phase breaking current. The power frequency recovery voltage shall be $2\sqrt{3}$ times the rated voltage for effectively earth neutral system. The control scheme of pole discrepancy is a part of circuit breaker.

6.6 The maximum noise level of the breaker when operated to close or open the three poles simultaneously shall be less than 140 dB at 1 m horizontal distance at the perimeter of circuit breaker with cabinet closed.

6.7 The circuit breaker shall be designed and constructed to operate mechanically without replacement of parts due to breakage or excessive wear or adjustments for 10000 operations each consisting of a complete opening and closing of the circuit breaker.

6.8 The power carrying circuits shall be capable of carrying its rated current at rated frequency continuously without excessive maintenance. The terminals and the connections between parts shall be designed to ensure permanently low resistance contacts.

i. The temperature-rise if carried out at 40^{o}C ambient temperature of contacts, connections, terminals and all other material used as an insulation and metal parts of the circuit breaker shall be in accordance with the values given in Table-3 of **IEC 62271-1** with a reduction of 10^{o}C(K). For carrying the temperature-rise at other ambient conditions, the normal current may be increased by multiplying the necessary correction factor as per temperature versus current curve of the circuit breaker to ascertain whether the offered current rating comply with the requirements of said specification or not when actually work at 40^{o}C ambient condition.

ii. The quality of contacts shall be such that a continuous layer of coating material remains in the contact area after making & breaking test, short time withstand test and mechanical endurance test, otherwise the contacts may be considered " bare" for consideration in temperature-rise test.

iii. The maximum temperature of the auxiliary circuits and devices, when the circuit breaker is carrying rated currents and voltages and when tested in accordance with the relevant clauses of IEC 62271-1 shall not exceed the values given in Table-3 of IEC 62271-1 with the exception that the reference ambient temperature shall be taken as 50 deg. C.

7.0 GENERAL CONSTRUCTIONAL REQUIREMENTS

7.1 The design shall be such that installation, replacement and general maintenance may be undertaken with a minimum of time and all parts are easily assemble and protected from rusting or corrosion.

7.2 The pole column shall rest on a common circuit breaker base. The pole columns shall be filled with SF6 for arc quenching and insulating purposes. The arc interrupting mechanism shall be designed with ample mechanical and electrical factors of safety in all of its parts.

7.3 It shall be possible to make independent adjustment to each pole of the circuit breaker. In the event of any phase failing to complete a closing operation, provisions shall be made for automatic tripping of the circuit breaker.

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

7.5 To facilitate transport, lifting lugs, jacking pads or other handling devices, capable of supporting each unit when fully erected and ready for service, shall be provided.

7.6 Each circuit breaker shall be equipped with two earthing terminals capable of accommodating bare stranded copper earthing conductors of 95 sq.mm cross-section. The earthing terminals shall be capable of carrying the rated short time current of the breaker and shall be distinctly marked.

7.7 Provision shall be made in the design of breakers to ensure that the proper operation of circuit breakers and accessories is not impaired by vermin, insects, small animals and birds etc.

7.8 All exposed surfaces of frames, tanks, operating mechanism etc., which would normally be painted when in service, shall be given one rust-protective coat of paint and at least one coat of a synthetic resin having excellent weather resistant properties. The total paint thickness shall not be less then 0.08mm (80 microns). All exposed parts of circuit breakers shall be weather-proof.

7.9 No leakage for gas shall occur under specified conditions of operation and there shall be no entrance of moisture or other gases. The maximum annual leakage of SF6 gas shall be 0.5% of the total volume of SF6 in a pole of circuit breaker. The quantity of SF6 gas shall comply with the acceptance level of relevant IEC standard.

7.10 All moving parts shall be suitably covered and expulsion vents shall be oriented to prevent any hazards to personnel or adjacent equipment.

7.11 No current transformers shall be built into the circuit breakers.

7.12 **External Insulation / Insulators**

7.12.1 External insulation shall be provided by means of glazed, non-hygroscopic porcelain insulators and shall conform to relevant IEC Standard. All porcelain insulators shall be wet process, homogeneous and free from cavities and other defects.

7.12.2 Circuit breaker porcelain unit & support column, shall be designed to withstand internal pressure of three times the maximum operating pressure and shall have the same Insulation Level as the breaker. These shall be airtight under pressure and shall have adequate mechanical strength to withstand the wind loads, seismic stress, static and dynamic forces from conductor.

7.12.3 Circuit breaker porcelain insulators shall have following minimum creepage distance from live to earthed parts for operation under the prevailing atmospheric conditions:

Circuit Breaker Rated Voltage (kV)	Minimum Creepage Distance (mm)
145	3900
72.5	1960
36	970

7.12.4 The colour of insulators shall be chocolate brown and tested in accordance with IEC-60273. Manufacturer's type & routine Test reports shall be submitted at the time of pre-delivery inspection.

8.0 LOCAL & REMOTE CONTROLS AND INDICATIONS

8.1 Circuit breakers shall be suitable for operation by electrical means either from the local operating cubicle or remotely from the control room. The operation selector switch (Remote-Neutral-Local) shall be a key operated switch provided in each operating cubicle for operation of the circuit breaker. Provision shall also be made to lock the cubical doors with padlocks.

8.2 A multiple, hand operated lockable change-over switch labelled 'Remote' and 'Local' shall be provided in each operating cubicle for establishing the point of control.

8.3 A reliable, easily readable, mechanically operated indicator shall be provided on each circuit breaker to show the position of the circuit breaker. The marking of indicator plates shall be "ON" and "OFF".

9.0 ELECTRICAL CONTROL FEATURES

9.1 Functional Requirements

The circuit breaker control scheme shall comply with the following essential control requirements.

9.1.1 The circuit breaker shall be mechanically and electrically trip-free.

9.1.2 The circuit breaker mechanism shall make one complete closing operation including automatic cut off of the closing power after an initiating control device has operated and the first device in the control scheme has responded, even though the contacts of the initiating control device are opened before the circuit breaker closing operation is completed.

9.1.3 The circuit breaker shall incorporate anti-pumping feature. Anti pumping relay shall be integral part of the circuit breaker to ensure that the circuit breaker shall

not repeatedly opened & closed in the event of simultaneous ON & OFF commands and also to avoid continuously energizing of circuit breaker closing coil, once the circuit breaker has already closed. Only one closing operation of the circuit breaker mechanism shall result from each closing operation of a manually operated initiating control device, even though the circuit breaker trips while the initiating control device is being held in the closed position. The control scheme needs not provide against re-closure in the event that control power is removed by casual and entirely random occurrences, such as the opening of a control circuit to check for grounds, while the initiating control device remains closed.

9.1.4 When power is removed from the closing control circuit after or during an incomplete closing operation, all electrically operated devices in the control circuit shall reset to the normal circuit breaker open position, except for those devices which require a supply of control power in order to assume their normal circuit breaker open position.

9.1.5 When the circuit breaker is in the closed position, a closing operation of an initiating control device shall not result in an operation of the circuit breaker closing mechanism.

9.1.6 When a closing operation of a circuit breaker cannot be completed successfully because of the absence of an adequate supply of stored energy, all actuating devices in the control circuit shall remain in the normal circuit breaker open position when the initiating control device is operated.

9.1.7 Electrical tripping facilities for the operating mechanism of each pole of circuit breaker shall be duplicated. These shall include atleast the following:-

i. Two electrically independent and identical trip coils for each pole of the circuit breaker shall be provided and so arranged that failure of one trip coil shall not affect the operation of second trip coil. Both the coils shall be physically separated and magnetically complied. In the event of three pole operation, control system shall include circuitry to trip the circuit breaker by energizing both sets of trip coils if pole – disagreement occurs.

ii. Two electrically independent and identical sets of wiring, terminals and protecting equipment shall be provided for connection to independent control of closing and tripping circuits.

9.1.8 Low and high SF6 gas pressure interlocking devices shall be fitted. Temperature compensated SF6 Gas density monitor shall be provided with two level alarms. First stage alarm shall be actuated when SF6 gas pressure drops below the normal operating pressure as specified by the manufacturer and second stage alarm shall cause opening/closing lockout in the event of gas pressure falling below the minimum value prescribed for the successful interruption of the current. It shall also give annunciation on control panel.

9.1.9 Provision shall be made by placing all the shut valves in the control mechanism to measure the SF6 gas pressure of each pole by closing the valves of other two poles in the operating mechanism.

9.1.10 Interlocking features both electrical & mechanical and related equipment alongwith their signalling and annunciation as required for reasons of safety and convenience of operation shall be provided. Electrical interlocking shall also be provided in the control & protection circuits of individual pole and the complete circuit breaker. Interlocking design shall also prevent closing operation when the circuit breaker is already in closed position and closing operation during an opening operation.

9.2 **Auxiliary Circuits**

The auxiliaries provided as part of each circuit breaker assembly, shall be as described herein.

9.2.1 Extra auxiliary switches, four normally open and four normally closed, in addition to those normally provided as part of the circuit breaker operation and indication functions, shall be provided.

9.2.3 All auxiliary equipment including wiring shall be adequately protected against rain and humidity. A thermostatically controlled anti condensation heaters/heating resistors shall be provided in each control cubical and shall be protected through a two-pole miniature circuit breaker to protect sensitive components from condensed water during rapid temperature changes.

9.2.4 When individual compressor motors are used, a two-pole miniature circuit breaker shall be connected in the supply to the compressor motor.

9.2.5 The auxiliary switch and circuits shall be able to carry 10A current continuously and rated short time withstand current of 100A for 50m sec.

10.0 **OPERATING MECHANISM**

The operating mechanism unit contains all components required for operation, monitoring and control of circuit breaker. The operating mechanism shall be motor operated spring charged and meet the following requirements.

10.1 The mechanism shall be designed such that the failure of spring will not prevent tripping and will not cause tripping or closing.

10.2 The circuit breaker operating mechanism and all accessories shall operate satisfactorily at 50^{o}C ambient temperature within the following range of voltages:

Rated Voltage	**Control Voltage**	**Operating Mechanism Voltage**	**Tripping Voltage**
110 V DC	90 – 130	90 – 130	77 - 130
220 V DC	180 – 260	180 – 260	154 – 260
240 V AC		200 – 260	
415 V AC		345 – 450	

10.3 The closing mechanism shall not prevent or delay the opening of the circuit breaker beyond the standard interrupting time and the energy shall be removed automatically from the closing mechanism when the closing operation is completed.

10.4 A conveniently located purely mechanical manual tripping device shall be provided. Latches shall be so designed as not to require delicate or frequent adjustments.

10.5 The mechanism shall be designed and constructed to operate mechanically without replacement of parts due to breakage or excessive wear or adjustments for 10000 operations each consisting of a complete opening and closing of the circuit breaker. The mechanically operation counter without resetting facility provided inside the cubicle shall be visible and readable from outside and shall count one full count on the closing cycle of circuit breaker.

10.6 The closing mechanism shall be recharged automatically for further operation as soon as the circuit breaker has completed a closing operation. If the closing mechanism is not fully recharged within a pre-determined time, the mechanism shall be locked out and an alarm initiated.

10.7 Each part of the mechanism shall be of substantial construction, utilizing such materials as stainless steel, brass or gunmetal, where necessary, to prevent sticking due to rust or corrosion. The overall design shall be such as to reduce mechanical shock to a minimum and shall prevent inadvertent operation due to fault current stresses, vibrations or other causes. A convenient means for applying lubricant shall be provided where required.

10.8 All permanently fixed bolts, nuts and studs shall be securely locked in place to prevent loosening during operation. Blind tapped holes shall be avoided where practicable.

10.9 The auxiliary switch shall be mechanically coupled with circuit breaker mechanical operating arrangement.

10.10 The energy required for switching the circuit breaker shall be stored in closing spring common to all tree poles and opening spring. In closed position of the circuit breaker, the energy stored in motor compressed spring shall be sufficient for an Open-Close-Open operation at rated short circuit current.

10.11 The charging motor shall be 110V DC motor. No diode/bridge circuit is allowed for converting AC to DC. The motor shall not require more than 15 seconds to re-charge the closing springs after a close-open operation. If the closing mechanism is not fully recharged, the mechanism shall be locked out and an alarm initiated.

10.12 Means shall be provided to prevent operation of the mechanism when maintenance work is being done.

10.13 The mechanism shall be so designed that emergency manual spring charging shall be made by using hand crank and release of the springs is possible without electrical operation.

10.14 Operating mechanism shall be provided with the indictor to show the charged/discharged state of spring.

11.0 OUTDOOR CONTROL CUBICLE

11.1 Circuit breaker operating mechanism, auxiliary switches and associated relays, control switches, control cable terminations and other ancillary equipment shall be accommodated in vermin-proof, dust-proof and weather proof cubicles. The cubicles shall be preferably free standing with front and rear access. The degree of protection shall be IP55 in accordance with IEC-62271-1.

11.2 Cubicles shall be made of galvanized steel sheet of 2.0 mm minimum thickness or corrosion free painted aluminium alloy sheet of 3.0 mm minimum thickness and shall be of rigid construction and shall include any supporting steel work necessary for mounting on the circuit breaker or on concrete foundations. Access to all compartments shall be provided by either removable panels or doors with lift off hinges. Bolts or carriage keys shall not be used to secure the panels or doors. All fastenings shall be integral with the panel or door and provision shall be made for pad locking.

11.3 Cubicles shall be well ventilated through vermin-proof louvers comprising a brass/aluminium gauze screen attached to a frame and secured to the inside of the cubicle. Divisions between compartments within the cubicle shall be perforated to assist air circulation.

11.4 Arrangement of equipment within the cubicle shall be such that access for maintenance or removal of any item shall be possible with the minimum disturbance. Suitable door gaskets made of neoprene rubber shall be provided to prevent ingress of moisture etc.

11.5 Circuit breaker cubicles shall be provided with a 240 V, 5A single phase three pin socket outlet protected by MCB shall be mounted within the cubicle. Means for interior lighting shall be provided within each cubicle assembly. Lamps shall be 240 V.A.C. and shall be automatically switched on when the door is opened.

11.6 An approved schematic diagram, of installations, identifying the various components within the cubicle and on the circuit breaker instructions shall be affixed to the inside of the cubicle access door. The diagram shall be marked on durable non-fading material suitable for the specified climatic conditions.

11.7 All incoming auxiliary supply cables shall be terminated directly into switch fuse isolators without intermediate terminals and provision shall be made for looping these supplies into similar cubicles in the switchyard. The entrance of cables in the cubicles shall be accomplished having brass glands with neoprene gaskets.

11.8 In case, the cubicles are mounted separately on concrete foundations, the same shall be equipped with one earthing terminal for earth conductor of 95 sq. mm.

11.9 **Wiring**

11.9.1 The wiring shall be such that individual components of the applicable control circuits of closing power devices, closing control devices and tripping devices shall be electrically grouped and terminated in physically separate groups.

11.9.2 The terminals of the control circuit components as stated above and the heater circuits and the individual compressor or spring charge motor circuits shall be readily accessible, closely grouped, and conveniently arranged for making connections between control circuits grouped and for external wiring.

11.9.3 Wiring between devices and terminal blocks shall be carried in troughs or in neatly formed packs which shall be tied or otherwise secured at appropriate intervals to prevent undue stress on equipment or connections. Connections across portions which are hinged or otherwise movable shall be made with flexible wire, formed to distribute the bending motion. No connections shall be made with wire smaller than 2.5mm^2. The cable used in wiring shall conform to relevant IEC standard.

11.9.4 Both ends of each wire shall be identified by a closed ring type ferrule of plastic label having weather resistant properties securely attached to the wire with no possibility of detachment under normal handling. The ferrules for closing circuits shall be of a colour preferably green and marked "close". The ferrules on all wiring directly connected to circuit breaker trip coils, tripping switches etc. shall be of a colour, preferably red, different from that of the remainder and marked "Trip".

Alternatively both ends of each wire shall be identified by machine lettered permanent fiber printed at least 50mm from the end of wire. Ground wire has no number and identified by cable colour. Following colour identification shall be applied:

3 PHASE AC	**1 PHASE AC**	**DC**	**COLOUR**
Phase 1	Phase	Positive	Red
Phase 2	-	-	Yellow
Phase 3	-	-	Blue
Neutral	Neutral	Negative	Black
Ground	-	-	Green

11.9.5 No. wires shall be tied or jointed between terminal points. Electrical wiring and instruments shall be so located that leakage of oil or water cannot affect them. Bus wiring between control panels etc. shall be fully insulated and completely segregated from the main panel wiring. Stacking of more than two wires on a terminal will not be permitted.

11.9.6 All metallic cases of instruments, control switches, relays etc. mounted on control panels or in cubicles, shall be provided with an accessible copper tail to facilitate connection by means of bare copper conductors of not less than 2.5mm^2 section to the nearest earth bar.

11.9.7 All the auxiliary relays, gauges and terminals blocks shall conform to relevant IEC/International standards and shall be so located as to permit easy access and ample room for repair/replacement of the components and every component shall have its location No. properly labelled as per schematic diagram.

11.10 **Terminal Blocks.**

11.10.1 Terminal blocks shall be mounted at an easily accessible position and shall be equipped with barriers, terminal strips and colour coded strips. The AC, DC, and current and potential transformer circuits shall be physically segregated in groups. The AC 415/240 volt circuit terminals will be fitted with non inflammable transparent plastic covers to prevent accidental contact with live parts.

11.10.2 Each incoming and outgoing cable shall be connected to an individual terminal. Each terminal block shall have an individual marking strip which shall be machine lettered or engraved with the circuit designations of the terminals which shall also be shown on the wiring diagram. One spare marking strip shall be provided for each terminal block. Approximately 10 percent extra terminals shall be provided on each block for terminating spare conductors and for future changes. In case of hinged panels matching terminal blocks shall be provided on both sides of the hinged section.

12.0 ELECTROMAGNETIC COMPATIBILITY (EMC)

The control & auxiliary circuit including components used in control cubical mounted on or adjacent to circuit breaker shall be able to withstand electromagnetic disturbances without damage and malfunctioning both under normal operation, switching conditions and interruption under fault conditions.

13.0 CIRCUIT BREAKER SUPPORTING STRUCTURE

13.1 Each circuit breaker shall be supplied alongwith two leg steel supporting structures by the circuit breaker manufacturer, its foundations/grouting bolts etc. on which the type tests of circuit breaker were performed. Supply of steel supporting structure from other sources/local representative will not be accepted.

All structural material shall be hot dip galvanized. Drawings and data such as dynamic forces, static forces, impact loading and terminal load of circuit breaker shall be provided. The foundation drawings shall be designed using the soil bearing capacity of 1 kg/cm² and suitable to withstand the seismic stress/magnitude according to Richer-scale ≥ 7 (horizontal acceleration up to 5m/s² (0.5g) for safety of equipment under heavy earth quake conditions unless otherwise specified in the tender. Design calculations and guidelines shall also be supplied.

13.2 The dimensions indicated in drawing No.PDW/TS-3217 are minimum values and for guidance only. The manufacturer shall submit their own drawings without affecting the interchangeability requirement of the foundation bolts as indicated in detail B of the drawing. The circuit breaker manufacturer may design the steel supporting structure according to their requirements and fulfilling the wind load, wind speed and other forces involved at the time of opening/closing of the circuit breaker under fault condition. The change in dimensions of foundation arrangement is not allowed.

13.3 The steels shall conform to the requirements as to tensile properties prescribed below:

	Mild Steel	High Tensile Steel
Tensile strength kg/mm^2		
Minimum	40	50
Maximum	56	80
Yield points kg/mm^2		
Minimum	26	35
Elongation in 200mm guage Length percent, minimum		
Upto 8mm Thickness	16	15
Over 8mm Thickness	20	18

13.4 All bolts and nuts shall be hexagonal type made from mild steel. The bolts shall be provided with one flat washer under each nut.

13.5 All grouting bolts for fixing the structures to the foundation shall be from High Tensile Steel. Washers shall not be less than 5 mm thickness and only one thickness of washer shall be used. The diameter of the washer and bolt holes shall be 1.5mm larger than the bolt diameter and the outside diameter of washer shall not be less than 1.5mm larger than the diagonal of the nut.

13.6 All connection bolts nuts, lock nuts and washers shall be furnished in excess of actual number required in quantity at least 5% greater than actual requirements sufficient to compensate for normal field losses.

13.7 All main legs/ structural material shall be coupled with foundation arrangement & top plate with nuts & bolts only. No connection with welding at the base and top is allowed.

13.8 All members with its identification marks shall be coupled with main structural members/legs through nuts & bolts only. Welding of members with legs is not allowed.

13.9 Prior to galvanizing, material shall be drilled, punched, cut or otherwise fabricated as required, free from burrs, cleaned so that zinc coating shall be adherent, dense, smooth, continuous and uniform. It shall also be completely free from lumps, blisters, uncoated or porous spots, black spots, dross, flux or any other imperfection.

13.10 The weight of zinc coating and thickness of zinc coating on angles shall not be less than 600gm/mm^2 and 0.010 mm respectively.

13.11 The weight of zinc coating and thickness of zinc coating on nuts & bolts shall not be less than 380gm/mm^2 and 0.035 mm respectively. The brinell hardness of bolts & nuts shall be between 120 to 200 HB. The ultimate strength and other properties of the nuts & bolts not listed above shall conform to relevant International standard viz British/ASTM/IEC etc.

13.12 Acceptance Tests:

The following acceptance tests shall be carried out on one complete structure out of lot offered for inspection.

For Section and Plates

1. Visual examination
2. Verification of dimensions and weights
3. Assembly tests
4. Tensile tests
5. Bend Tests
6. Impact tests
7. Galvanizing tests
   - Weight of zinc coating
   - Uniformity of zinc coating
   - Adherence of zinc coating
   - Embitterment test

For Nuts and Bolts

1. Verification of dimensions
2. Visual inspection
3. Proof load test
4. Ultimate tensile strength test
5. Hardness test

6. Galvanizing tests
   - Weight of zinc coating
   - Uniformity of zinc coating
   - Adherence of zinc coating
   - Embitterment test

Test reports shall be furnished by the manufacturer as per relevant international standard and conforming to above requirements.

14.0 TERMINAL HEAD AND TERMINAL CONNECTOR

14.1 Provision for four Nos., suitable size, two way terminal head shall be provided so that the breaker can be connected in any configuration to other allied equipment viz: disconnectors, current transformers etc.

14.2 Mono-metallic or Bimetallic terminal connector as per requirement of terminal head alongwith stainless steel nuts and bolts suitable for connection between terminal heads and 600mm^2 Aluminium conductor shall be provided with each pole of the circuit breaker. The connectors shall be bolted type having nuts & washers. The connectors with single bolt technology are not acceptable.

14.3 The material and composition of the Aluminium alloy used on monometallic connectors and the Aluminium portion of the bimetallic connectors shall be properly heat treated. Keepers and components which are subjected to high forces during services, will be obtained by gravity die casting with following characteristics:

Ultimate tensile strength, min	=	24 kg/ mm^2
Yield strength, 0.2% off set, min	=	15.5 kg/mm^2
Elongation, min	=	3% on 50 mm scale
Electrical conductivity, min	=	38% IACS
Brinell hardness, min	=	100 HB

14.4 The copper alloy shall be from the Copper/Nickel base family of alloys with a minimum of 96.4% of copper in order to guarantee high conductivity properties as well as high strengths characteristics. Copper alloy shall be heat treated. Bronze or Brass alloys are not acceptable.

The copper alloy shall have the following characteristics:

Ultimate tensile strength Rm, min	= 20 kg/ mm^2, (196.2) N/mm^2, (196.2) MPa
Yield strength Re 0.2% ,min	= 10 kg/mm^2, (98.1) N/mm^2, (98.1) MPa
Elongation (min)	= 18% on 50 mm scale
Electrical conductivity at 20^{0}C	= 32% IACS (min)

14.5 The bolts, nuts and washers shall be of stainless steel having following properties:

Breaking strength, min	=	65 kg/ mm^2
Yield strength, min	=	40 kg/mm^2
Brinell hardness, min	=	140 HB

14.6 **Type Tests**

The type test reports for the following tests from on connector bodies, keepers shall be furnished by the connector manufacturer as per relevant international standard and conforming to above requirements.

a. Material composition test
b. Tensile strength test
c. Elongation test
d. Brinell hardness test
e. Heat cycle test
f. Conductivity test
g. Radio interference voltage and corona tests
h. Short circuit test

15.0 **NAME PLATE DATA**

15.1 A stainless steel name plate shall be placed on the operating mechanism cubicle and shall include at least the following with engraved text in accordance with valid IEC 62271-100 which shall be visible in position of nominal service and installation.

a. Contract No./P.O. & date
b. Manufacturer's name.
c. Manufacturer's type designation and serial number.
d. Year of manufacture
e. Standard to which manufactured
f. Rated voltage, U_r (kV)
g. Rated frequency, (Hz)
h. Rated normal current, (A)
i. Rated operating Sequence.
j. Rated lightning impulse withstand voltage, (kV)
k. Rated symmetrical breaking capacity, (kA)
l. Rated short time current (1 sec.) (kA)
m. Making capacity, (kA)
n. Rated out of phase breaking current, (kA)
o. Rated line charging breaking current, (kA)
p. Rated cable charging breaking current, (kA)
q. First pole to clear factor
r. Total break time at rated breaking current in ms. (cycles).
s. Reclosing time, (msec).
t. Maximum RIV level at 500 KHz, 110% of rated voltage, (µV)

u. Rated supply voltage of auxiliary circuit, (V)
v. Rated supply voltage of closing & opening devices and ranges of operating voltages.
w. Type of operating mechanism
x. Weight per pole, (kg)
y. No. of trip coils per pole
z. Volume and weight of SF6 gas per pole, (litre/kg)
za. Rated pressure of SF6 gas at 20^{o}C (bars)
zb. Mass per pole with SF6 gas, (kg)
zc. Total mass of complete circuit breaker, (kg)

16.0 SPARE PARTS

16.1 The following mandatory spare parts shall be supplied free of charge for each group of five sets of circuit breakers of same characteristics and ratings:-

Sr. No.	**Description**	**Quantity**
1.	Single Pole circuit breaker complete with support insulator but excluding operating mechanism, base frame steel supporting structure	1 No.
2.	Closing coils	1 No.
3.	Trip coils	1 Nos.
4.	SF6 gas in standard container of 40kg.	1 container
5.	Complete set of control and shut off valves alongwith seals.	1 Set
6.	Gas density monitors	1Nos.
7.	SF6 Gas filling kit containing control valve for connection to gas container and 20m gas filled hose with connector	1 Set
8.	Handles for Manual Charging of closing springs	5 Nos.

16.2 The bids offering circuit breakers without above spare parts will be loaded @ five percent of the bid price for comparison purpose.

17.0 SPECIAL TOOLS

17.1 A set of standard tools required for the purpose of maintenance and over-hauling of circuit breakers shall be supplied free of charge for each lot of five circuit breakers. The list of standard tools shall be furnished with the bid and also at the time of approval of drawings.

17.2 The bids offering circuit breakers without above tools will be loaded @ one percent of the bid price for comparison purpose.

18.0 **TESTS**

18.1 All type and routine tests shall be performed in accordance with the IEC Publication 62271-100 amended to date.

18.2 **Type Tests**

18.2.1 Identification of Circuit Breakers for Type Test

The type test reports shall incorporate design information and details sufficient to identify the design of the tested circuit breaker with that of other circuit breakers proposed to be of the same design and construction. Such information shall include, but is not restricted to the following:

i) Drawing of circuit breaker general assembly.

ii) Details of arc control devices, contacts and operating and coupling mechanism of the breaker.

iii) The outline and other important dimensions such as the travel of moving contacts etc.

iv) The details of mountings, fixings and insulators.

v) The working details of operating mechanisms such as operating voltage and pole pieces for operating coils, etc.

vi) The resistance of main circuit measured before and after the type tests

18.2.2 The following type tests in accordance with IEC 62271-100 shall be made on a complete three pole circuit breaker having same current & voltage ratings to be supplied in presence of two representatives one from Design, NTDC and other from purchaser at an STL approved Lab at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives to prove compliance with the requirements as listed in this specification after every ten years. However, duly certified and complete type test reports for tests carried out by an independent lab like KEMA Lab Holland, CESI Lab Italy on the complete three pole circuit breaker having same design, current & voltage ratings shall be acceptable in lieu of actual tests provided the dates of testing shall not be more the 10 years from the date of opening of the bid. The test report having higher current carrying capacity shall be acceptable only if the bidder shall undertake to supply the exactly the same higher current rating breaker in lieu of the lower current rating breaker as ordered, otherwise the bidder shall have to perform all the type tests on the offered current rating circuit breakers. Test carried out at manufacturer's own/approved lab will not be accepted if not witnessed by the NTDC representative.

1- Dielectric tests.
2- Radio Interference Voltage Test.
3- Measurement of the resistance of the main circuit.
4- Measurement of Temperature and Temperature-Rise.
5- Temperature rise test of control and auxiliary circuit.
6- Short-time withstand current and peak withstand current tests.
7- Verification of IP coding test.
8- Tightness test.
9- Electromagnetic Compatibility (EMC) tests.
10- Mechanical operation test at ambient temperature including extended mechanical endurance test.
11- High Temperature test.
12- Static terminal load test.
13- Short-circuit current making and breaking tests.
14- Critical current test.
15- Earth fault test.
16- Capacitive current switching tests.
17- Short-line fault test.
18- Out of phase making & breaking test.
19- Electrical Endurance test.

The type test report for the above tests alongwith complete drawings of tested circuit breaker duly stamped by the lab shall be submitted with the bid.

18.3 **Routine Tests**

18.3.1 The manufacturer shall perform routine tests on all circuit breakers according to respective clauses of IEC-62271-100 and test reports shall be submit at the time of pre-delivery inspection. The following routine tests shall be witnessed by the two representatives one from Design, NTDC and other from purchaser at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives to prove compliance with the requirements as listed in this specification on 10% of the quantity of ordered circuit breakers to be selected randomly from the total lot of circuit breakers.

a. i) Verification of name plate data.
ii) Check of constructional and performance requirement.
iii) Visual & dimensional verification of circuit breaker assembly, steel supporting structures, terminal head and terminal connectors.
iv) Check earth terminal and quality of paint.
v) Check all wiring in accordance with the approved drawing
vi) Verification of all components/devices used in operating mechanism/control cabinet according to the approved drawing.
vii) Checking of motor & spring charging requirements.
viii) Checking of anti pumping function.
ix) Checking of spare auxiliary contacts.
x) Check function of SF6 gas density monitor.

xi) Measurement of creepage distance.
xii) Verify all components/devices are correctly labelled.
xiii) Check all interlocking arrangements/functions.
xiv) Verification of Technical Data values.
xv) Verification of manufacturer's type & routine test reports of insulators, steel supporting structures, terminal head and terminal connectors according to relevant IEC standards.

b. Inspection of spare parts & special tools as mentioned in clause No.16 & 17. A list of the same shall be included in the inspection certificate.

c. Measurement of the resistance of the main circuit. The measured resistance should not exceed the resistance of the type tested circuit breaker and approved by Design, NTDC.

d. Mechanical operating tests.

Mechanical operating tests shall include the following:

i) At maximum supply voltage of operating devices and of auxiliary and control circuits and maximum pressure for operation:
- Five closing operations and Five opening operations;

ii) At specified minimum supply voltage of operating devices and of auxiliary and control circuits and minimum functional pressure for operation:
- Five closing operations and Five opening operations;

iii) At rated supply voltage of operating devices and of auxiliary and control circuits and rated pressure for operation:
- Five closing operations and Five opening operations;
- Five close-open operating cycles with the tripping mechanism energized by the closing of the main contacts;
- Five open close operating cycles O – t - C where t shall be not more than the time interval specified for the rated operating sequence (t = 0.3 seconds/dead time for circuit-breakers intended for rapid auto-reclosing).

vii) For all required operating sequences the following shall be performed and records made of the closing and opening operations:-
- Mechanical characteristics for opening & closing operations
- Measurement of closing time.
- Measurement of Opening time.
- Time travel Chart
- Stored energy operations tests.

v) After completion of the required operating sequences, the following tests and inspections shall be performed:-

- Connections shall be checked;
- The control and/or auxiliary switches shall correctly indicate the open and closed positions of the circuit-breaker;
- All auxiliary equipment shall operate correctly at the limits of supply voltage of operating devices and of auxiliary and control circuits and/or pressures for operation.

vi) Furthermore the following tests and inspections shall be made:-

- Measurement of the resistance of heaters and of the control coils;
- Inspections of the wiring of the control, heater and auxiliary equipment circuits and checking of the number of auxiliary contacts, in accordance with the order specification;
- Inspection of control cubicle
- Recharging duration(s);
- Operation of electrical, mechanical interlocks and signalling devices;
- Operation of anti-pumping device;
- General performance of equipment within the required tolerance of the supply voltage;
- If adjustments are required during the mechanical operating tests, the complete test sequence shall be repeated following the adjustments.

e. Power frequency voltage with-stand dry tests on the main circuit.

f. Tests on control and auxiliary circuits.

This includes dry short duration power frequency voltage withstand test, inspection of auxiliary & control circuits, verification of conformity to the circuit diagram and wiring, components, functional tests, verification of protection against electric shock and degree of protection (IP Code)

18.3.2 The acceptance/inspection certificate clearly indicate the performance of above tests during pre-delivery inspection/testing and test results shall be submitted to the Purchaser.

19.0 DRAWINGS AND DESCRIPTIVE DATA

19.1 Data to be submitted with the bid

19.1.1 Supply record of offered type, current & voltage rating circuit breaker for last five years on the following format:

Sr. No.	Contract/Purchase Order No. & date	Quantity	Current rating	Delivery period	Client Address/ Phone/ Fax No./ E-mail, etc.

19.1.2 The schedule of technical data duly filled-in attached hereto. The word indicating "as per specification/standard" will not be acceptable.

19.1.3 The module indicating the equipment in the circuit breaker assembly and components used in the operating mechanism, control cubicle, etc.

19.1.4 Manufacturer's catalogues/drawings as required in the schedule of technical data.

19.1.5 Non submission of completely filled-in schedule of technical data and supply record on the above format or submission of incomplete information/data as mentioned above with the bid, may render the bid non-responsive.

19.2 Approval Drawings and Data to be submitted after Award of Contract/Purchase Order

The following drawings/descriptive data shall be submitted for approval of Design Department NTDC before manufacturing the equipment:

i. Schedule of technical data duly filled-in along with supporting documents.

ii. Instruction Manual for installation indicating site test procedure before energizing/operation, maintenance/replacement of components procedure and storing requirements of the Circuit breaker.

iii. Name plate data of the circuit breaker and charging mechanism.

iv. Dimensional & outline drawing of circuit breaker showing dimensions of each individual part including terminal studs for high voltage connections and size of terminals for earthing.

v. Foundation/grouting drawings showing static and dynamic loading of circuit breaker during the opening and closing operation and other design data.

vi. Schematic and wiring diagrams of control scheme including closing, tripping, auxiliary circuits, alarm & Interlocking circuits, and operating mechanism shall be furnished on individual page with cross reference. Trip-1 & Trip-2 circuit shall be segregated.

vii. Description & quantity of components/ equipments/ devices indicating the symbols with their manufacturer's name & country of origin and electrical characteristics, etc.

viii. Dimensional drawings of outdoor control cubicle.

ix. The chart or the curve and the procedure for showing the breaker rating factors for evaluating the breaking capacity on various auto-reclosing duty cycles of the offered circuit breakers.

x. Drawing of steel supporting structures, terminal head and connectors with type test report.

xi. List of spare parts and tools to be supplied.

xii. Earth quake simulation test and response calculations.

20.0 PACKING

The circuit breaker and all allied material including steel supporting structures shall be supplied in packing suitable for transport by rail/road and sea as per international practice. Special precaution may be essential for protection of insulation during transport to prevent moisture absorption due, for instance, to rain, snow or condensation. In every package of equipment for shipment one number installation, erection, maintenance and operation instruction book enclosed in water proof material shall be provided. Bill of quantity shall indicate the quantity, size, length, weight and assembly mark of each member of structure including nuts & bolts, washers, plates, foundation bolts and all fittings complete for structure, circuit breaker including terminal head & connector etc.

21.0 ENCLOSURES

Following drawings and data sheets are attached herewith:

1. Schedule of technical data for circuit breaker
2. Circuit breaker supporting structure — Drawing No. PDW/TS/3217
3. Mono-metallic terminal connector — Drawing No. PDW/DF-309(1)
4. Bimetallic terminal connector — Drawing No. PDW/DF-325

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SCHEDULE OF TECHNICAL DATA FOR CIRCUIT BREAKER

GENERAL

1. Manufacturer's name & address _____
   (Attach Manufacturer's catalogue/broucher with the bid)

2. Type/designation of offered circuit breaker _____

3. Offered Circuit Breaker Class
   - i. w.r.t Mechanical Endurance _____
   - ii. w.r.t Electrical Endurance _____
   - iii. w.r.t.Capacitive Current Breaking _____
   - iv. w.r.t Connection to Overheard Line _____

4. No. of poles of Circuit Breaker _____

5. Suitability for three phase/single phase operation and rapid reclosing _____

6 Is the offered circuit breaker conforms to all constructional & performance requirements of the specification (if not, give list of deviations) _____

7. Type Tests.
   - i. Report issuing lab with No. and Date _____
     (Attach copy of type test reports)
   - ii. Current rating of tested circuit breaker _____
   - iii. Rated Short Circuit Breaking Current _____
   - iv. Rated duration of short circuit current _____
   - v. Resistance of Main circuit of tested circuit breaker. _____
   - vi. Whether complete type test as per IEC 62271-100 were carried out at an independent lab.(if not, give details). Yes/No
   - vii. Whether the details of circuit breaker for type tests as required in clause 18.2.1 have been attached with the bid Yes/No

RATINGS

1.	Rated voltage(U_r), rms	(kV)	_____
2.	Nominal voltage, rms	(kV)	_____
3.	Highest operating voltage	(kV)	_____
4.	Lowest operating voltage	(kV)	_____
5.	Lightning Impulse withstand voltage		
	i) Phase to Phase	(kV)	_____
	ii) Phase to Earth	(kV)	_____
6.	One minute Power Frequency withstand voltage		
	i) Phase to Phase	(kV)	_____
	ii) Phase to Earth	(kV)	_____
7.	Rated Frequency	(Hz)	_____
8.	Rated Continuous current of offered circuit breaker	(A)	_____
9.	Max. continuous current of offered Circuit Breaker	(A)	_____
10.	Rated short circuit breaking current for 1 sec, rms	(kA)	_____
11.	Rated short circuit breaking current for 3 sec, rms	(kA)	_____
12.	Rated D.C. component	(%)	_____
13.	Rated short time withstand current for 1 sec, rms	(kA)	_____
14.	Rated short time withstand current for 3 sec, rms	(kA)	_____
15.	Rated peak withstand current, rms	(kA)	_____
16.	Rated short-circuit making current (Peak)	(kA)	_____
17.	Rated operating sequence		_____
18.	Rated out-of-phase breaking current at rated voltage	(kA)	_____

19. Line-charging breaking capacity:

    i) Rated current (kA) _____
    ii) Over voltage factor (p.u) _____

20. Cable charging breaking current at rated voltage (kA) _____

21. Single capacitor bank breaking current (A) _____

22. Rated Back to back capacitor bank switching current (A) _____

23. Max. RIV at 1 MHz at 10% above rated voltage ($1.1U_r/\sqrt{3}$) (μV) _____

24. First Pole to Clear Factor (FPCF)

25. Resistance of main circuit of the offered circuit breaker at 20^oC ambient temperature (μΩ) _____

26. Transient recovery voltage for terminal faults (1.5 F.P.C. factor)

    i) At 100% rated short circuit breaking current

u_l- first reference voltage	(kV)	_____
t_1- first time co-ordinate	(μ Sec)	_____
u_c- TRV peak value	(kV)	_____
t_2- second time co-ordinate	(μ Sec)	_____
t_d- time delay	(μ Sec)	_____
u´- voltage co-ordinate	(kV)	_____
t´- third time co-ordinate	(μ Sec)	_____
u_1/t_1- Rate of Rise of Recovery Voltage	(kV/μSec)	_____
K_{af} - Amplitude Factor	(p.u)	_____

    ii)At 60% rated short circuit breaking current:

u_l- first reference voltage	(kV)	_____
t_1- first time co-ordinate	(μ Sec)	_____
u_c- reference voltage TRV peak value	(kV)	_____
t_3- time to reach u_c	(μ Sec)	_____
t_d- time delay	(μ Sec)	_____
u´- delay line voltage co-ordinate	(μ Sec)	_____
t´- delay line time co-ordinate	(kV)	_____
t_3- initial rate of rise	(μ Sec)	_____
u_1/t_1- Rate of Rise of Recovery Voltage	(kV/μSec)	
K_{af} - Amplitude Factor	(p.u)	_____

    _____

iii)At 30% rated short circuit breaking current

u_l- first reference voltage	(kV)	_____
t_1- first time co-ordinate	(µ Sec)	_____
u_c- reference voltage TRV peak value	(kV)	_____
t_3- time to reach u_c	(µ Sec)	_____
t_d- time delay	(µ Sec)	_____
u´- delay line voltage co-ordinate	(µ Sec)	_____
t´- delay line time co-ordinate	(kV)	_____
t_3- initial rate of rise	(µ Sec)	_____
u_1/t_1- Rate of Rise of Recovery Voltage	(kV/µSec)	_____
K_{af} - Amplitude Factor	(p.u)	_____

iv) At 10% rated short circuit breaking current

u_l- first reference voltage	(kV)	_____
t_1- first time co-ordinate	(µ Sec)	_____
u_c- reference voltage TRV peak value	(kV)	_____
t_3- time to reach u_c	(µ Sec)	_____
t_d- time delay	(µ Sec)	_____
u´- delay line voltage co-ordinate	(µ Sec)	_____
t´- delay line time co-ordinate	(kV)	_____
t_3- initial rate of rise	(µ Sec)	_____
u_1/t_1- Rate of Rise of Recovery Voltage	(kV/µSec)	_____
K_{af} - Amplitude Factor	(p.u)	_____

27. Transient Recovery Voltage for short line faults

u_1- first reference voltage	(kV)	_____
t_1- first time co-ordinate	(µ Sec)	_____
u_c- TRV peak value	(kV)	_____
t_2- second time co-ordinate	(µ Sec)	_____
t_d- time delay	(µ Sec)	_____
u´- voltage co-ordinate	(kV)	_____
t´- third time co-ordinate	(µ Sec)	_____
u_1/t_1- Rate of Rise of Recovery Voltage	(kV/µSec)	_____
K_{af} - Amplitude Factor	(p.u)	_____

28. Transient Recovery Voltage for out of phase

u_1- first reference voltage	(kV)	_____
t_1- first time co-ordinate	(µ Sec)	_____
u_c- TRV peak value	(kV)	_____
t_2- second time co-ordinate	(µ Sec)	_____
t_d- time delay	(µ Sec)	_____
u´- voltage co-ordinate	(kV)	_____
t´- third time co-ordinate	(µ Sec)	_____
u_1/t_1- Rate of Rise of Recovery Voltage	(kV/µSec)	_____
K_{af} - Amplitude Factor	(p.u)	_____

PERFORMANCE DATA

1. Maximum ambient temperature range (°C) _____

2. Whether circuit breaker is capable of switching of :
   - i) Power Transformers Yes/No
   - ii) Capacitor Banks Yes/No
   - iii) Charging current of over head lines/cables Yes/No

3. Resistance of main circuit at 20°C (μΩ) _____

4. Current carrying capacity of offered circuit breaker at different ambient temperatures (Attach Ambient Temperature Vs Current curve with the bid)
   - i. Max. Continuous Current at 50°C Ambient (A) _____
   - ii. Max. Continuous Current at 40°C Ambient (A) _____
   - iii. Max. Continuous Current at 30°C Ambient (A) _____
   - iv. Max. Continuous Current at 20°C Ambient (A) _____
   - v. Max. Continuous Current at 10°C Ambient (A) _____

5. Temperature rise at at 50°C Ambient Temperature:
   - i) Contacts (°C) _____
   - ii) Terminals (°C) _____
   - iii) Other metal parts (°C) _____

6. i) Rated voltage of :
   - a) Closing coil (V DC) _____
   - b) Tripping coil (V DC) _____

   ii) Rated power consumption of :
   - a) Closing coil (W) _____
   - b) Tripping coil (W) _____

7. i) Heater voltage (V) _____
   ii) Heater Power (Watts) _____

8.	Range of rated control and auxiliary supply viz:		
	i) Control- Max./Min.	(V DC)	_____
	ii) Charging Motor-Max./Min.	(VDC)	_____
	iii) Tripping voltage – Max./Min.	(V DC)	_____
	iv) Three phase AC system	(VAC)	_____
9.	Tolerance in operating time	(m sec)	_____
10.	Rated closing time	(m sec)	_____
11.	Rated break time	(m sec)	_____
12.	Rated make time	(m sec)	_____
13.	Rated dead time	(m sec)	_____
14.	Rated open-close time	(m sec)	_____
15.	Rated close-open time	(m sec)	_____
16.	Rated Arcing time	(m sec)	_____
17.	Rated pre-arcing time	(m sec)	_____
18.	Rated reclosing time	(m sec)	_____
19.	Rated Re-make time	(m sec)	_____
20.	Rated opening time	(m sec)	_____
21.	Maximum clearing time during test duty T_{100a}	(m sec)	_____
22.	No. of switching operations permissible at:		
	i) 100% short circuit breaking current	(No.)	_____
	ii) 60% short circuit breaking current	(No.)	_____
	iii) 30% short circuit breaking current	(No.)	_____
	iv) Max. continuous current carrying capacity	(No.)	_____
23.	Max. time interval between first and last pole for 3 phase pole operation	(m sec)	_____
24.	Make-break time	(m sec)	_____
25.	Pre-Insertion time	(m sec)	_____
26.	Min. close duration	(m sec)	_____

27.	Min. Trip duration	(m sec)	_____
28.	Electrical Endurance	(Nos.)	_____
29.	Mechanical endurance	(Nos.)	_____
30.	Max. noise at a distance of 10m from the breaker and 2meter from base during opening and closing operation	(dB)	_____

CONSTRUCTION

(Attach internal view of a pole of circuit breaker showing all the components with a detail legend with the bid)

1.	No. of breaks per pole	(No.)	_____
2.	No. of trip coils for pole	(Nos.)	_____
3.	Total length of break per pole	(mm)	_____
4.	No. of operating mechanism for 3-phase circuit breaker		_____
5.	Whether two electrically independent & identical trip coils for each pole of the circuit breaker have been provided.		Yes/No
6.	Whether two electrical independent sets of wiring, terminals and protection equipment have been provided		Yes/No
7.	Whether circuit breaker is trip free		Yes/No
8.	Provision of anti pumping device		Yes/No
9.	Degree of protection of outdoor control cubical		_____
10.	Thickness of control cubical sheet		_____
11.	Material of sheet.		_____
12.	Whether all the shut valves are provided in the operating mechanism		Yes/No
13.	Type of operating mechanism:		
	i) Opening mechanism		_____
	ii) Closing mechanism		_____

14.	i)	Rated voltage of the charging motor in the operating mechanism	(V)	_____
	ii)	Total power consumption of motor	(Watts)	_____
15.		Whether thermal magnetic protection provided for the motor.		Yes/No
16.		Whether emergency manual charging & release of spring is possible without electrical operation		Yes/No
17.		Whether the indicator to show the charged/discharged state of spring has been provided in the operating mechanism		Yes/No
18.		Whether all the local & remote control indications as mentioned at clause 8 have been available. (If not, give details)		Yes/No
19.		Whether all functional requirements as listed in 9.1 have been complied. (If not, give details)		Yes/No
20.		No. of close open operation possible with the stored energy	(No.)	_____
21.		Time required for the motor to recharge the closing spring		_____
22.		Description of safety alarms provided		
		a)_____		_____
		b)_____		_____
		c)_____		_____
		d)_____		_____
		e)_____		_____
23.	i)	Whether SF6 gas conforms to IEC 376		Yes/No
	ii)	Normal SF6 gas Pressure at $20^{o}C$	(Bars)	_____
	iii)	Maximum SF6 gas Pressure at $20^{o}C$	(Bars)	_____
	iv)	Minimum SF6 gas Pressure at $20^{o}C$	(Bars)	_____
	v)	SF6 gas Pressure alarm Stage-I	(Bars)	_____
	vi)	SF6 gas Pressure alarm Stage-II	(Bars)	_____
	vii)	Total volume of SF6 gas per pole	(Litres)	_____
	viii)	Leakage of SF6 gas per year per circuit breaker	(ml)	_____
24.		No. of earthing terminals for $95mm^2$ copper conductor	(Nos.)	_____
25.		Material of Earthing terminal		_____

26. Capability of carrying rated short time current of earthing terminal (kA) _____

27. Contacts:

    i) Material _____
    ii) Type of plating _____
    iii) Thickness of plating material _____
    iv) Contact pressure _____
    v) Dimensions _____
    vi) Current density at continuous current (A/mm^2) _____

28. i) Total No. of auxiliary contacts:
        a) Normally Open _____
        b) Normally Closed _____

    ii) No. of spare auxiliary contacts:
        a) Normally Open _____
        b) Normally Closed _____

29. Thickness of galvanized steel sheet used for outdoor control cubical (mm) _____

30. Dimensions of inspection window of outdoor control cubicle (mm) _____

31. Whether all wiring comply with clause 11.9.4 Yes/No

32. Whether the outdoor control cubicle comply with the requirements of clause 11(if not, give detail) Yes/No

33. Type of gasket to prevent ingress of moisture _____

34. Whether the AC circuit of outdoor control cubicle is fitted with non-flammable transparent plastic cover to prevent accidental contact with lower part _____

35. No. of extra terminals for future termination _____

36. Size of cable used in wiring (mm^2) _____

37. Minimum height of circuit breaker (mm) _____

38. Minimum phase spacing between poles (mm) _____

39. Minimum earth clearance of circuit breaker (mm) _____

40. Minimum clearance between moving and stationary parts when the circuit breaker in the open position (mm) _____

41. i) Minimum creepage distance between live terminals (mm) _____
    ii) Minimum creepage distance phase to earth (mm) _____

42. Size and section of terminal bolts (attach drawing) (mm) _____

43. Impact vertical loading per pole (kg/kN) _____

44. Horizontal loading of operating mechanism. (kg/kN) _____

45. Impact vertical loading of operating mechanism. (kg/kN) _____

46. Maximum shock load on foundation while opening on fault. (kg) _____

47. Dimensions for steel support:

    i) Height _____
    ii) Breadth _____
    iii) Width _____
    iv.) Structure fixing foundation details _____

48. Circuit breaker withstand capability
    i) Wind velocity m/sec _____
    ii) Wind Load m/sec _____
    iii) Earth quake
        a) Richer-scale
        b) Horizontal acceleration (g)

49. Foundation Loading details. _____

50. Terminal Connectors suitable for 600 mm^2 Al. Conductor (Attach manufacturer's broucher/drawings with the bid)

    i) Manufacturer's Name _____
    ii) Type
    iii) Weight
    iv) Current carrying capacity
    v) Short circuit withstand current
    vi) Tensile Strength
    vii) Elongation
    viii) Hardness
    ix) Type Tests (Attach copy)

51. Weight per pole of circuit breaker (kg) _____

52. Weight of complete circuit breaker (kg) _____

INSULATOR

1. Manufacturer/country of origin (Attach catalogue/broucher/drawing with the bid) _____

2 Type of insulator _____

3. Diameter of insulator _____

4. No. of units per column _____

5. Creepage distance (Phase to Earth) _____

6. Phase to phase clearance _____

7. Type test report issuing lab with No. & date (Attach copy of test report) _____

8. Power frequency withstand test voltage
   a) Dry 1 minute _____
   b) Wet 10 sec _____

9. Impulse withstand voltage _____

10. Max RIV at 1 MHz

11. Ultimate strength of column _____

12. Withstand Pressure

i)	Cantilever	(N)
ii)	Tension	(N)
iii)	Torsion	(N)
iv)	Compression	(N)
v)	Bending	(N)

13. Material and colour _____

STEEL STRUCTURE
(Attach drawing/photograph with the bid)

1. Name of Manufacturer/Country of origin _____

2. Tensile Strength of angles, nuts & bolts Min./Max. Kg/mm^2 _____

3.	Yield point Min.	Kg/mm^2	_____
4.	Elongation in 200m guage	(%)	_____
5.	Weight of Zinc Coating of angles/nuts & bolts		_____
6.	Thickness of zinc coating angles/nuts & bolts		_____
7.	Hardness of nuts & bolts		_____
8.	Total weight of supporting steel structure with foundation bolts		_____
9.	Designed soil bearing capacity		_____
10.	Seismic withstand stress/magnitude. (Attach design calculations)		_____

TERMINAL HEAD:
(Attach drawing/photograph with the bid)

1.	Name of Manufacturer		_____
2.	Material of terminal head		_____
3.	Current Carrying Capacity of terminal head		_____
4.	Dimensions of terminal head	(mm)	_____
5.	Material of terminal head		_____
6.	Weight of terminal head		_____
7.	Whether 4 Nos. two way terminal head are provided.		Yes/No

CONNECTORS
(Attach drawing/photograph with the bid)

1.	Name of Manufacturer/Country of origin	_____
2.	Material of connector (Whether Monometallic aluminium alloy or Bimetallic)	_____
3.	Material of keeper	_____
4.	Current Carrying Capacity of connector	_____

5.	Tensile Strength (Aluminium/Copper)		_____
6.	Elongation (Aluminium/Copper)	%	_____
7.	Hardness of Aluminium/Copper		_____
8.	Electrical conductivity of Aluminium/Copper		_____
9.	Short Circuit Rating		_____
10.	Material of Nuts & Bolts		_____
11.	Tensile Strength of Nuts & Bolts		_____
12.	Brinell Hardness of Nuts & Bolts		_____

NAME PLATE DATA

1.	Whether the data listed in clause 14 is engraved on the name plate		_____
2.	Material/Thickness of name plate		_____

SPARES & SPECIAL TOOLS

1.	Whether spares & tools as required at clause 15 will be provided with each lot of circuit breakers	Yes/No
2.	Whether special tools as per clause 16 been provided with each lot of circuit breaker for maintenance & repair (Attach detail list)	Yes/No

PACKING AND SHIPPING

1.	No. of packages to be shipped	((Nos.)	_____
2.	Weight of each package	(kg)	_____

****

NATIONAL TRANSMISSION AND DESPATCH COMPANY

NTDC SPECIFICATION P-181:2012

METAL – OXIDE SURGE ARRESTERS WITHOUT GAPS
(FOR 11KV, 33KV, 66KV, 132KV, 220kV & 500KV A.C. SYSTEMS)

DESIGN DEPARTMENT NTDC

C O N T E N T S

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0.0 FOREWORD

0.1 This specification has been prepared by Standards & Research Directorate of the Design Department NTDC. This third edition cancels and replaces the earlier editions published in 1985 & 1996 and its amendments and draft specification for 500kV surge arresters.

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

0.3 This specification is subject to revision as and when required by S&R directorate of Design NTDC only. No other department is authorized to make/issue amendment in the said specification.

1.0 SCOPE

This specification is applicable to single phase/pole non-linear, metal-oxide resistor type surge arresters without spark gaps along with steel supporting structures, grouting bolts, terminal connector for connection to external aluminium conductor as applicable and operation on three phase solidly earthed system having voltages of 11kV, 33kV 66kV, 132kV, 220kV, & 500kV, 50 Hz, A.C. systems for protection of power transformers, and other electrical equipments by limiting the lightning and transient/switching surge voltages.

1.2 The Surge Arresters shall be designated as follows:

Sr. No.	Description	Designation
i.	Surge Arresters for 11 kV AC System	A
ii.	Surge Arresters for 33 kV AC System	B
iii.	Surge Arresters for 66 kV AC System	C
iv.	Surge Arresters for 132 kV AC System	D
v.	Surge Arresters for 220 kV AC System	E
vi.	Surge Arresters for 500 kV AC System	F

2.0 REFERENCE STANDARD

2.1 The surge arresters shall generally be designed, constructed and tested in accordance with the International Electro-technical Commission No. 60099-4 "Metal–Oxide Surge Arresters without gaps for AC system" amended to-date.

2.2 The definitions given in the IEC 60099-4 shall apply herein.

2.3 In case the requirements laid down herein differ from those given in the IEC Publications in any particular aspect, the requirements listed herein shall prevail.

3.0 DEFINITIONS

The definitions of IEC 60099-4 shall apply. Some of them are recalled here for ease of reference.

3.1 **Metal-oxide surge arrester without gaps**

An arrester having non-linear metal-oxide resistors connected in series and/or in parallel without any integrated series or parallel spark gaps.

3.2 **Non-linear metal oxide resistor**

The part of the surge arrester which by its non-linear voltage versus current characteristics acts as a low resistance to over-voltages, thus limiting the voltage across the arrester terminals and as a high resistance at normal power frequency voltage.

3.3 **Grading ring of an arrester**

A metal part, usually circular in shape, mounted to modify electrostatically the voltage distribution along the arrester.

3.4 **Pressure relief device of an arrester**

A means for relieving internal pressure in an arrester and preventing violent shattering of the housing following prolonged passage of fault current or internal flashover of the arrester.

3.5 **Rated voltage of an arrester (Ur)**

The maximum permissible r.m.s. value of power frequency voltage between its terminals at which it is designed to operate correctly under temporary over-voltage conditions as established in the operating duty tests. The rated voltage is used as a reference parameter for the specification of operating characteristics.

3.6 **Continuous operating voltage of an arrester (Uc)**

The continuous operating voltage is the designated permissible r.m.s. value of power frequency voltage that may be applied continuously between the arrester terminals, under specified conditions.

3.7 **Steep current impulse**

A current impulse with a virtual front time of 1µs with limits in the adjustment of equipment such that the measured values are from 0.9 µs to 1.1 µs. The virtual time to half value on the tail shall be not longer than 20 µs.

3.8 **Lightning current impulse**

An 8/20 current impulse with limits in the adjustment of equipment that the measured values are from 7 µs to 9 µs for the virtual front time and from 18 µs to 22 µs for the time to half value on the tail.

3.9 **Long duration current impulse**

A rectangular impulse which rises rapidly to maximum value, remains substantially constant for a specified period and then falls rapidly to zero. The parameters which defines a rectangular impulse are polarity, peak value, virtual duration of the peak and virtual total duration.

3.10 **Discharge current of an arrester**

The impulse current which flows through the arrester.

3.11 **Nominal discharge current of an arrester (In)**

The peak value of lightning current impulse which is used to classify an arrester.

3.12 **High current impulse of an arrester**

The peak value of discharge current having 4/10 impulse shape which is used to test the stability of the arrester on direct lightning strokes.

3.13 **Switching current impulse of an arrester**

The peak value of discharge current having a virtual front greater than 30 µs but less than 100 µs and a virtual time to half value on the tail of roughly twice the virtual front time.

3.14 **Continuous current of an arrester**

The continuous current is the current flowing through the arrester when energized at the continuous operating voltage.

3.15 **Residual voltage of an arrester (Ures)**

The peak value of the voltage that appears between the terminals of an arrester during the passage of discharge current.

3.16 **Reference voltage of an arrester (Uref)**

The peak value of power frequency voltage divided by √2 which shall be applied to the arrester to obtain the reference current. The reference voltage of a multi-unit arrester is the sum of the reference voltages of the individual units.

3.17 **Power frequency withstand voltage versus time characteristics of an arrester**

The power frequency withstand voltage versus time characteristics shows the maximum time duration for which corresponding power frequency voltages may be applied to arrester without causing damage or thermal instability, under specified conditions.

3.18 **Protective characteristics of an arrester**

The combination of the following:

a) Residual voltage for steep current impulse, under specified conditions.

b) Residual voltage versus discharge current characteristics for lightning impulses, under specified conditions.
The lightning impulse protection level of the arrester is the maximum residual voltage for the nominal discharge current.

c) Residual voltage for switching impulse, under specified conditions.
The switching impulse protection level of the arrester is the maximum residual voltage at the specified switching impulse currents.

3.19 **Thermal runway of an arrester**

The term “thermal runway” is used to describe a situation when the sustained power loss of an arrester exceeds the thermal dissipation capability of the housing and connections, leading to a cumulative increase in the temperature of the resistor elements culminating in failure.

3.24 **Housing**

External insulation part of an arrester which provides the necessary creepage distance and protects the internal parts from the environment.

3.20 **Porcelain housed attester**

Arrester using porcelain as housing material, with fittings and sealing systems.

3.21 **Polymer housed attester**

Arrester using polymeric and composite material for housing, with fittings.

3.22 **Thermal stability of an arrester**

An arrester is thermally stable if, after an operating duty causing temperature rise, the temperature of the resistor elements decreases with time when the arrester is energized at specified continuous operating voltage and at specified ambient conditions.

3.23 **Arrester disconnector**

A device for disconnecting the arrester from the system in the event of arrester failure, to prevent a persistent fault on the system and to give visible indication of the failed arrester.

3.25 **Bending Moment**

Horizontal force acting on the arrester housing multiplied by the vertical distance between the mounting base (lower level of the flange) of the arrester housing and the point of application of the force.

3.26 **Terminal line force**

Force perpendicular to the longitudinal axis of the arrester measured at the centre line of the arrester.

3.27 **Torsional Loading**

Each horizontal force at the top of a vertical mounted arrester housing which is not applied to the longitudinal axis of the arrester.

3.28 **Breaking load**

Force perpendicular to the longitudinal axis of a porcelain housed arrester leading to mechanical failure of the arrester housing.

3.29 **Damage limit**

Lowest value of a force perpendicular to the longitudinal axis of a polymer housed arrester leading to mechanical failure of the arrester housing.

3.30 **Specified long term load (SLL)**

Force perpendicular to the longitudinal axis of a arrester, allowed to be applied during service without causing any mechanical damage to the arrester.

3.31 **Specified Short term load (SSL)**

Greatest force perpendicular to the longitudinal axis of an arrester, allowed to be applied during service for short periods and for relatively rare events (e.g. short-circuit loads and extreme wind gusts) without causing any mechanical damage to the arrester. SSL does not relate to mechanical strength requirements for seismic loads.

3.32 **Mean breaking load (MBL)**

The average breaking load for porcelain or cast resin-housed arresters determined from tests.

3.33 **Temporary over-voltage (TOV)**

It is transient over voltage of oscillatory nature, other than surge over voltage, of relatively long duration such as appearing in case of system disturbances e.g. ferro-resonance, line-to-ground fault, load rejection etc.

3.34 **Line discharge class**

It specifies rated duty cycle and associated test requirements for arresters in respect of discharging long duration current impulse.

3.35 **Pressure relief class**

It represents the minimum rms value of symmetrical fault current that will operate the pressure relief device.

4.0 **SERVICE CONDITIONS**

The surge arresters and all accessories shall be suitable for satisfactory operation under the following service conditions:-

4.1 **Climatic Conditions**

4.1.1 **Ambient Temperature**

Maximum	50^{o}C.
Maximum mean over any 24 hours	45 ^{o}C.
Mean in any year	30 ^{o}C
Minimum	-10 ^{o}C

4.1.2 **Relative Humidity**

The relative humidity may range from 0 to 100 percent. The maximum value of the ambient temperature and humidity, however, do not occur simultaneously. During the monsoons, high humidity may persist for many days at a time along with temperatures ranging from 30°C to 40°C.

4.2 **Altitude**

The surge arresters shall be suitable for installation upto 1000 m above sea level.

4.3 **Atmospheric Conditions**

It may be assumed that the air is not normally heavily polluted by dust, smoke, aggressive gases, vapours or salt spray. However, at certain times of the year severe dust storms may be experienced.

4.4 **Wind Load**

The maximum wind load shall be taken as 122 kg/sq. m. (corresponding to wind speed of 44.2 m/s).

4.5 **Seismic Conditions**

The surge arresters along with steel supporting structures and foundation shall be suitable to withstand the seismic stress/magnitude according to Richer-scale up to 7 (horizontal acceleration up to 4m/s² (0.4g) for safety of equipment under heavy earth quake conditions unless otherwise specified in the tender. The foundation arrangement shall be designed using the soil bearing capacity of 0.5 to 1.0 kg/cm². Design calculations and guidelines shall also be supplied with the bid.

4.6 **Supply System**

The surge arresters shall be suitable for installation in 11kV, 33kV 66kV, 132kV, 220kV, & 500kV, three phase A.C solidly earthed supply system of the following characteristics:

Sr. No.	Designation of Surge Arresters →	A	B	C	D	E	F
a.	Highest System Voltage, kV rms,	12	36	72.5	145	245	550
b.	Nominal System Voltage, Un, kV rms.	11	33	66	132	220	500
c.	Frequency, Hz.	50	50	50	50	50	50

5.0 RATINGS AND CHARACTERISTICS

5.1 The surge arresters shall be so designed as to comply with the following ratings, characteristics and to meet all test requirements laid down herein :

Sr. No.	Designation of Surge Arresters →		A	B	C	D	E	F
a.	Highest System Voltage, (Um), kV rms.		12	36	72.5	145	245	550
b.	Nominal System Voltage, Un, kV, rms.		11.5	33	66	132	220	500
c.	Arrester Rated Voltage (Ur), kV.		12	36	60	120	198	444
d.	Rated Frequency, Hz.		50	50	50	50	50	50
e.	Continuous operating voltage (Uc), kV.		10.2	28.8	48	96	156	348
f.	Temporary over voltage (TOV), **1s /10 s**, kVrms.		12/ 11	36/ 33	70/ 64	138/ 130	228/ 216	515/ 488
g.	Nominal discharge current (In), kA peak.		10	10	10	10	10	20
h.	Line discharge class		1	1	2	3	3	5
i.	Short circuit withstand current, (0.2 s) kA sym.		20	20	20	40	50	63
j.	Pressure relief class		B	B	B	A	A	A
k.	High Current 4/10 µs Impulse withstand, kA peak.		100	100	100	100	100	100
l.	Switching Current Impulse Withstand (Upper value), Amp.		250	500	500	1000	1000	2000
m.	Max. Residual Voltage at 10kA Steep Impulse current wave of 1/20µs, kV.		45	110	175	330	545	1182
n.	Max. Residual voltage at lightning impulse current waves of 8/20 µs:							
	-	5 kA, kV peak.	36	93	156	282	456	960
	-	10 kA, kV peak.	40	100	168	300	486	1010
	-	20 kA, kV peak.	42	110	180	320	528	1110
	-	40 kA, kV peak.	44	126	204	360	600	1215

Sr. No.	Designation of Surge Arresters →		A	B	C	D	E	F
o.	Max. residual Voltage at Switching Impulse current wave of 30/60 µs:							
	-	500 A, kVpeak.	28	78	120	234	384	830
	-	1000 A, kVpeak.	30	80	126	246	402	865
	-	2000 A, kVpeak.	33	84	132	252	420	896
	-	3000 A, kVpeak.	35	88	136	258	429	920
p.	1.2/50 µs Lightning Impulse Withstand Voltage, kVpeak (Dry)		95	170	325	650	1050	1550
q.	Power frequency withstand voltage:							
	-	Dry, kV for 1 min.	42	80	160	315	530	780
	-	Wet, kV for 1 min.	38	70	140	275	460	680
r.	Internal partial discharge at 1.05 times the continuous operating voltage, ≤ pC.		10	10	10	10	10	10
s.	Max. RIV at 1.05 times continuous operating voltage, µV.		500	500	500	500	500	500
t.	Energy absorption capability, kJ/kV(Ur).							
	-	Thermal, kJ/kV.	3	4	5	7	8	15
	-	Impulse, kJ/kV.	2	2	3	5	5	10

6.0 CONSTRUCTIONAL REQUIREMENTS

6.1 General

6.1.1 Surge arresters shall be of non-linear, metal-oxide resistors type having no spark gaps. The metal–oxide blocks employed shall have minimum power loss which shall not increase during the life of the arrester when operating under the specified service conditions, especially the elevated ambient temperature, and with the maximum continuous operating voltage.

6.1.2 The metal–oxide resistors assembly shall be housed in a porcelain insulator of sufficient thermal and mechanical strength which shall be hermetically sealed to ensure against ingress of the moisture throughout the life of the arrester. The space

between the metal–oxide resistors blocks and the external housing shall be filled with a dry inert gas. Alternatively, this space may be filled with some suitable, field-proven, solid polymeric material such as silicone rubber.

6.1.3 The metal-oxide resistors shall possess superior nonlinear V-A characteristics and high energy/over-voltage absorption capability, high protection margin of discharge voltages at steep, lightning and switching surges. In addition, suitable means may be adopted as necessary to ensure rapid and effective self-cooling of the resistor blocks by efficient heat transfer in order to afford adequate temporary over voltage (TOV) capability.

6.1.4 Surge arresters shall be able to withstand the combination of stresses arising in service as demonstrated by the operating duty test. These stresses shall not cause damage or thermal runway.

6.1.5 The design of the arrester shall be such that a reasonably uniform potential drop will exist across each section of the arrester when operating under the specified service conditions. Moreover, the arrester will not flash over and the temperature increase of the arresters remains within the specified maximum temperature during live washing of arrester.

6.1.5 The 12kV arresters shall be built generally in accordance with Drawing No. PDW/TS-3205. The 33kV, 66kV, 132kV, 220kV & 500kV surge arresters shall be of pedestal type built generally in accordance with the enclosed drawings as applicable.

6.1.6 The 132kV, 220kV & 500 kV arresters shall be fitted with grading rings assembly. The metallic grading ring and ring support shall be of rugged design and construction to maintain the ring properly spaced under the specified service conditions.

6.1.7 The external housing in case of the arresters for 11kV, 33kV and 66kV systems may alternatively consist of suitable polymeric composite insulators of high mechanical strength and complying with the requirements of relevant IEC Standards in addition to the other applicable requirements given in this specification.

6.2 **Mounting**

6.2.1 The mounting arrangement of 12kV surge arrester shall be as per enclosed Drawing No. PDW/TS-7282.

6.2.2 The arresters of 33KV, 66kV, 132kV, 220kV & 500kV ratings shall be self supporting and designed to be mounted on steel structures as per enclosed drawings as applicable. The supporting steel structures shall be supplied with the arresters.

6.3 **Terminal Connectors**

6.3.1 The 12kV surge arrester shall be provided with a flexible fully insulated lead for the line terminal. All connections and parts shall be insulated so that no live metal parts are exposed. This insulated lead shall be of stranded tinned copper of not less than 13sq. mm cross section and shall be at least 45 cm in length. For grounded connection, a solderless clamp type terminal, capable of securely clamping stranded copper conductor of 6 to 10 mm diameter, shall be provided.

6.3.2 The line terminal of the 33kV& 66kV surge arrester shall consist of solderless clamp type connectors. The connector shall be made of high strength aluminum alloy and shall be designed for receiving stranded conductors of 12 mm to 26 mm diameter either in a horizontal or vertical direction.

6.3.3 The line terminal of the 132kV surge arrester shall consist of solderless clamp/ connector. The connector shall be made of high strength aluminum alloy and shall be designed for receiving stranded conductors of 20 mm to 38 mm diameter either in a horizontal or vertical direction.

6.3.4 The line terminal of 220kV arresters shall be a vertical stud of 30 mm dia and 80 mm length as per Drawing No. PDW/DF-387 and shall be made of tin/silver plated copper.

6.3.5 The line terminal of 500kV arresters shall comply with the requirements of the relevant international standard and subject to approval by the Purchaser.

6.3.6 For ground connections of 33kV, 66kV, 132kV, 220kV & 500kV ratings, a solder less clamp type terminal, capable of securely clamping stranded copper conductor of 10 to 15mm diameter, shall be provided to receive the conductor in horizontal direction.

6.3.7 The Specified Long term Load (SLL), Specified Short term Load (SSL) and Mean Breaking loads (MBL) shall be as per reference standards.

6.7 **Earthing Terminals**

Two number earthing terminals at diagonally opposite position shall be provided in arresters of 33KV, 66kV, 132kV, 220kV, & 500kV ratings. Each terminal shall be capable of carrying full short circuit current and be suitable for accommodating 95 to 120 sq mm copper earthing lead.

6.4 **Surge Counter**

6.4.1 132kV, 220kV and 500kV arresters shall be equipped with 3- digit cyclometer dial type surge counters without resetting facility for indicating through a transparent window the number of times the arrester has operated on account of lightning or

switching surges with built in ammeter for measurement of leakage current complying with the following parameters:

Sr. No.	Performance Required	Parameters
1.	Indication of counter	3 digit cyclometer
2.	Minimum operating current	50A (8/20 us)
3.	Max. high current withstand capability	100kA (4/10 us)
4.	Ammeter scale	0-5mA rms

6.4.2 The counters shall be of the type which permits measuring/monitoring/analyzing of the continuous leakage current without being disconnected. The monitor shall be supplied with an auxiliary contact rated 0.5A, 230V for remote signaling. Surge counters shall be sensitive enough to record the minimum discharge current likely to take place inside the arrester. Counters shall not require any refill charts or graphs.

6.4.3 The leakage current shall be indicated in three different color ranges in the ammeter to assess the healthiness of the surge arrester. One range indicate the normal range (surge arrester is in healthy status), second range indicate out of normal range (surge arrester or system to be checked) while third range indicate over normal range (surge arrester must be repaired/replaced).

6.4.4 Two terminals similar to the ground terminals of the arrester shall be provided with the counter. The counter shall be fully weather-proof and explosion-proof for full short-circuit current. It shall be visible and readable from outside.

6.4.5 The surge counter shall be subjected to severe electrical, mechanical and climate conditions. The type test reports for the following type tests shall be furnished by the arrester manufacturer.

a) Shock test as per IEC 60068.
b) Vibration test as per IEC 60068.
c) Temperature test as per IEC 60068.
d) Humidity test as per IEC 60068.
e) Impulse test as per IEC 60099-4.
f) Short-circuit test as per IEC 60099-4.
g) Salt fog test (For polymeric housed arresters).

7.0 BUSHING/POST INSULATOR

7.1 All porcelain insulators shall be wet process, homogeneous and free from cavities and other defects. The color of insulators shall be chocolate glazed brown and tested in accordance with IEC-60273. Manufacturer's type & routine Test reports shall be submitted at the time of pre-delivery inspection.

7.2 Porcelain insulators shall be designed to withstand internal pressure of three times the maximum operating pressure and shall have the same Insulation Level as the surge arrester. These shall be airtight under pressure and shall have adequate mechanical strength to withstand the wind loads, seismic stress, static and dynamic forces from conductor.

7.3 Porcelain insulators shall have following minimum creepage distance from live to earthed parts for operation under the prevailing atmospheric conditions:

Arrester Designation	Bushing Highest Voltage (kV)	Minimum Creepage Distance (mm)
A	12	350
B	36	970
C	72.5	1960
D	145	3900
E	245	7000
F	550	15000

7.4 The type test reports of the insulator shall be furnished by the arrester manufacturer as per relevant international standard and conforming to above requirements.

8.0 NAME PLATE MARKING

8.1 A corrosion resistant stainless steel name plate shall be securely attached to the surge arrester and shall include at least the following information marked in an indelible manner in accordance with IEC 60099-4. In case the arrester is composed of a number of a number of units, each unit shall also have an individual name plate. The name plate of lower unit shall be visible in position of nominal service and installation.

a) Manufacturer's name.
b) Designation and type.
c) Serial number.
d) Contract No./Purchase Order No. and date.
e) Rated voltage.
f) Continuous operating voltage.
g) Nominal discharge current.
h) Line discharge class and absorption capability in kJ.
i) Pressure relief class and rated fault current in kA
j) Residual voltages at 5, 10 & 20kA
k) Maximum permissible value of the resistive component of leakage current
l) Rated short circuit withstand current in kA.
m) Identification of assembling position of the unit.
n) Unit weight in Kg.

9.0 SUPPORTING STEEL STRUCTURE

9.1 Each surge arrester shall be supplied along with steel supporting structures, its foundations/grouting bolts etc. The origin of steel supporting structures shall be same as that of surge arresters. All structural material shall be hot dip galvanized.

9.2 The dimensions indicated in enclosed drawing are minimum values. The manufacturer shall submit their own design/drawings without affecting the interchangeability requirement of the foundation arrangement as indicated in detail B of the drawings. The manufacturer may design the steel supporting structure according to their requirements and fulfilling the wind load, wind speed and other forces involved on the surge arrester under fault conditions. The change in dimensions of foundation arrangement is not allowed.

9.3 The steel shall conform to the requirements as prescribed below:

Tensile strength:

Minimum, kg/mm^2	50
Maximum, kg/mm^2	80
Yield points kg/mm^2 Min.	35

Elongation in 200mm gauge Length:

Upto 8mm Thickness, % min.	15
Over 8mm Thickness, % min.	18

9.4 All nut and bolts shall be hexagonal type made from steel grade 6.8 (ISO 898) and provided with one flat and one lock washer under each nut. All connection bolts nuts, lock nuts and washers shall be furnished in excess of at least 5% greater than actual requirements sufficient to compensate for normal field losses.

9.5 All grouting bolts for fixing the structures to the foundation shall be from High Tensile Steel. Washers shall not be less than 5 mm thickness and only one thickness of washer shall be used. The diameter of the washer and bolt holes shall be 1.5mm larger than the bolt diameter and the outside diameter of washer shall not be less than 1.5mm larger than the diagonal of the nut.

9.6 All main legs/structural material shall be coupled with foundation arrangement & top plate with nuts & bolts only. No connection with welding at the base and top is allowed.

9.7 All members with its identification marks shall be coupled with main structural members/legs through nuts & bolts only. Welding of members with legs is not allowed.

9.8 Prior to galvanizing, material shall be drilled, punched, cut or otherwise fabricated as required, free from burrs, cleaned so that zinc coating shall be adherent, dense, smooth, continuous and uniform. It shall also be completely free from lumps, blisters, uncoated or porous spots, black spots, dross, flux or any other imperfection.

9.9 The weight and thickness of zinc coating on angles shall not be less than 600gm/m^2 and 0.010 mm respectively.

9.10 The weight and thickness of zinc coating on nuts & bolts shall not be less than 380gm/m^2 and 0.035 mm respectively. The brinell hardness of bolts & nuts shall be between 120 to 200 HB. The ultimate strength and other properties of the nuts & bolts not listed above shall conform to relevant International standard viz British/ASTM/IEC etc.

9.11 **Acceptance Tests:**

The following acceptance tests shall be carried out on one complete structure out of lot offered for inspection.

For Section and Plates

1. Visual examination
2. Verification of dimensions and weights
3. Assembly tests
4. Tensile tests
5. Bend Tests
6. Impact tests
7. Galvanizing tests
   - Weight of zinc coating
   - Uniformity of zinc coating
   - Adherence of zinc coating
   - Embitterment test

For Nuts and Bolts

1. Verification of dimensions
2. Visual inspection
3. Proof load test
4. Ultimate tensile strength test
5. Hardness test
6. Galvanizing tests
   - Weight of zinc coating
   - Uniformity of zinc coating
   - Adherence of zinc coating
   - Embitterment test

Test reports shall be furnished by the manufacturer as per relevant international standard and conforming to above requirements.

10.0 TERMINAL CONNECTOR

10.1 Mono-metallic or Bimetallic terminal connectors as per requirement of terminal head with stainless steel nuts and bolts suitable for connection between terminal heads and aluminum conductor having dia of 26 to 38mm shall be provided with the surge arrester. The connectors with single bolt technology i.e. without nut & washers are not acceptable. The bimetallic connectors shall have separate copper and aluminium bodies joined by a suitable bimetal strip joint with 2mm of thickness. The connectors employing bimetallic shims shall not be accepted.

10.2 The material and composition of the Aluminum alloy used on monometallic connectors and the Aluminum portion of the bimetallic connectors shall be properly heat treated. Keepers and components which are subjected to high forces during service, will be obtained by gravity die casting. Aluminum alloy and keepers shall have the following characteristics:

Ultimate tensile strength, min	=	24 kg/ mm^2
Yield strength, min	=	15.5 kg/mm^2
Elongation, min	=	3% on 50 mm scale
Electrical conductivity, min	=	38% IACS
Brinell hardness, min	=	100 HB

10.3 The copper alloy shall be from the Copper/Nickel base family of alloys with a minimum of 96.4% of copper in order to guarantee high conductivity properties as well as high strengths characteristics. Copper alloy shall be heat treated. Bronze or Brass alloys are not acceptable.

The copper alloy and keepers shall have the following characteristics:

Ultimate tensile strength, min	=	20 kg/ mm^2
Yield strength ,min	=	10 kg/mm^2
Elongation (min)	=	18% on 50 mm scale
Electrical conductivity at 20^0C	=	32% IACS (min)

10.4 The bolts, nuts and washers shall be of stainless steel having following properties:

Breaking strength, min	=	65 kg/ mm^2
Yield strength, min	=	40 kg/mm^2
Brinell hardness, min	=	140 HB

10.5 The type test reports for the following tests for connector bodies, keepers shall be furnished by the connector manufacturer as per relevant international standard and conforming to above requirements.

a. Material composition test
b. Tensile strength test
c. Elongation test
d. Brinell hardness test
e. Heat cycle test
f. Conductivity test

11.0 TESTS

11.1 Tests shall be performed to ascertain that, as regards design, size, material and manufacture, the surge arresters complies with the specified rating, characteristics and operational requirements. The arrangement, test conditions, and criteria to pass the tests shall be in accordance with relevant clauses of IEC 60099-4 amended to date.

11.2 Type Tests

11.2.1 Duly certified and complete type test reports for tests carried out at KEMA Lab Holland and CESI Lab Italy on the surge arresters having same design, voltage ratings shall be acceptable in lieu of actual tests. The validity of the type tests reports shall be 10 years. In case of non-production of the requisite type test reports or if the type test reports are otherwise not acceptable to the Design NTDC, the following tests shall be performed on the surge arrester having same voltage ratings as ordered in presence of two representatives one from Design, NTDC and other from purchaser at any STL approved Lab or any other lab approved by design NTDC at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives.

a) Insulation withstand tests on arrester housing (Dry & Wet):
   i) Lightning impulse voltage test (dry).
   ii) Switching impulse voltage test (dry) (For type E & F arresters only)
   iii) Power frequency voltage test (Dry & Wet).
b) Residual voltage tests;
   i) Steep current impulse residual voltage test.
   ii) Lightning impulse residual voltage test.
   iii) Switching impulse residual voltage test.
c) Long duration current impulse withstand test.
d) Operating duty tests:
   i) High current impulse operating duty test.
   ii) Switching surge operating duty test.
e) Short circuit Test.
f) Tests of arrester disconnectors (For arresters fitted with disconnectors)
g) Artificial pollution test (For porcelain housed multi unit surge arresters).
h) Internal partial discharge test.
i) Bending moment test (For porcelain housed surge arresters for Um>52kV)
j) Environmental test (For porcelain housed surge arresters)
k) Seal leak rate test.
l) Radio interference voltage (RIV) test.
m) Weather ageing test (For polymer housed arresters).
o) Current distribution test (For multi column arresters).
p) Power frequency voltage verses time test.
q) Pressure relief test.
r) Salt fog test (For polymeric housed arresters).

11.2.2 The housing shall withstand the following voltages during Insulation withstand tests on arrester housing:

- The lightning impulse protection level of the arresters multiplied by 1.3.
- The switching impulse protection level of the arresters multiplied by 1.3.
- Housing of type A, B, C & D arresters shall withstand a power frequency voltage with a peak value equal to the switching impulse protection level multiplied by 1.06 for a duration of 1 minute.

11.2.3 Visual examination of the samples after type tests shall reveal no evidence of puncture, flashover, cracking or other significant damage of the metal-oxide resistors. The residual voltage measured before and after the long-duration current test shall not have changed by more than 5%.

11.2.4 Following visual inspection/checks on the assembly subject to type tests shall also be carried out and made part of the type test report.

i) Verification of name plate data.
ii) Check of constructional and performance requirements.
iii) Visual & dimensional verification of arrester assembly, steel supporting structures, terminal connectors and earth terminals.
iv) Measurement of creepage distance.

11.2.5 **Test Reports**

The type test report for the above tests along with complete outline drawings, data, photographs, details of supporting structure, record of test quantities of tested surge arrester duly stamped by the independent lab shall be submitted with the bid. The type test reports shall incorporate details sufficient to identify the design of the tested surge arrester. Such information shall include, but is not restricted to the following:

i) Drawing of arrester general assembly.
ii) The details of mountings, fixings and insulators.
iii) Rated cantilever strength of Insulators.
iv) Rated torsional strength of insulators.
v) Creepage length and shed profile.
vi) Height of insulators.
vii) Type test reports of Insulator.

11.3 **Routine Tests**

11.3.1 The manufacturer shall perform routine tests on all surge arresters according to respective clauses of IEC-60099-4 and test reports shall be submit at the time of pre-delivery inspection.

11.4 **Acceptance Tests**

11.4.1 The following acceptance tests shall be made on 5% of the quantity of ordered surge arresters to be selected randomly from the total lot offered for pre-delivery inspection/testing in presence of two representatives one from Design, NTDC and other from Purchaser at the cost and arrangement of the manufacturer including travel expenses, boarding, lodging and daily allowance for the representatives. The arrangement, test conditions, and criteria to pass the tests shall be in accordance with relevant clauses of IEC 60099-4 amended to date.

a) Measurement of power frequency voltage.
b) Lightning impulse residual voltage.
c) Internal partial discharge test.
d) Seal leak rate test.
e) Current distribution test (For multi column arresters).
f) Special thermal stability test

11.4.2 One complete surge arrester shall be fitted on the steel supporting structure for following examination:

i) Visual inspection and Measurement of dimensions
ii) Verification of name plate data.
iii) Check of constructional and performance requirements.
iv) Visual & dimensional verification of supporting structures, terminal connectors and earth terminals.
v) Verification of type, model, test report, data & drawing, and creepage distance of bushing/post insulator.
vi) Verification of Metal Oxide Blocks data, drawing, test report.

11.4.3 The acceptance/inspection certificate clearly indicate the performance of above tests during pre-delivery inspection/testing and test results shall be submitted to the Purchaser. A copy of bill of quantity indicating the total quantity of each component, parts, structure, their accessories, etc, duly signed by the inspectors(s) required for consignee for verification on receipt of material in warehouse/store shall also be attached with the inspection certificate.

12.0 **DRAWINGS AND DESCRIPTIVE DATA**

12.1 **Data to be submitted with the bid**

12.1.1 Supply record of offered type, voltage rating of surge arresters for last five years on the following format:

Sr. No.	Contract/Purchase Order No. & date with quantity.	Type of Arrester	Rated Voltage	Delivery period	Client Address/ Phone/ Fax No./ E-mail, etc.

12.1.2 The schedule of technical data duly filled-in attached hereto along with supporting documents. The word indicating "as per specification/standard" will not be acceptable.

12.1.3 Dimensional & outline drawing of surge arresters showing dimensions and each individual part including, pressure relief device, operation counter, terminal head for high voltage connections, size of terminals for earthing, terminal connector and details of the mounting arrangements.

12.1.4 Non submission of completely filled-in schedule of technical data and supply record on the above format or submission of incomplete information/data as mentioned above with the bid may render the bid non-responsive.

12.2 **Approval Drawings and Data to be submitted after Award of Contract/Purchase Order**

The following drawings/descriptive data shall be submitted for approval of Design Department NTDC before manufacturing the equipment:

i. Schedule of technical data duly filled-in along with supporting documents.

ii. Instruction Manual for installation indicating site test procedure before energizing/operation, maintenance/replacement of components procedure and storing requirements of the surge arresters.

iii. Dimensional & outline drawing of surge arresters showing dimensions and each individual part including, pressure relief device, operation counter, terminal head for high voltage connections, size of terminals for earthing, terminal connector and details of the mounting arrangements.

iv. Sectional drawing of the surge arrester indicating the inner details.

vi. Power frequency voltage versus time characteristics of an arrester.

vii. Technical catalogue in respect of the bushings.

viii. Installation, erection, maintenance and operation instruction manuals.

ix. Type test reports for similar type of arresters and operation counters shall be furnished. The test reports shall incorporate all necessary details and relevant data/information about the tested equipment in sufficiency for ascertaining the validity of the test report and evaluation of the tests results.

x. Drawings of steel supporting structure, foundation/grouting bolt drawing showing static and dynamic loading of surge arresters. Photographs in fully arranged and erected condition.

xi. Type test reports of insulator, terminal connectors.

xii. Rating plate drawing and earth quake simulation and response calculations.

13.0 PACKING

The surge arrester and all allied material including steel supporting structure, connector, etc. shall be supplied in individual wooden box suitable for transport by rail/road and sea as per international practice. Special precaution may be essential for protection of insulation during transport to prevent moisture absorption, for instance, due to rain, snow or condensation. In every pack of equipment for shipment one number installation, erection, maintenance and operation instruction book enclosed in water proof material shall be provided. Bill of quantity shall indicate the quantity, size, length, weight and assembly mark of each member of structure including nuts & bolts, washers, plates, foundation bolts and all fittings complete for structure, connector etc.

14.0 ENCLOSURES

a. Schedule of Technical Data for Surge arresters.

b. Supporting Steel Structure for Surge Arresters Drawing No. PDW/TS/3203 (Revision dated 03-09-2012).

c. Typical 12kV Surge Arrester Drawing No. PDW/TS/3205 (Revision dated 03-09-2012).

d. Mounting arrangement for 12kV Surge arresters Drawing No. PDW/TS/7282 (Dated 03-09-2012).

e. 33kV and 66kV Surge Arresters with insulating base Drawing No. PDW/TS/3206 (Revision dated 03-09-2012).

f. 132kV Surge Arresters with insulating base Drawing No. PDW/TS/3207 (Revision dated 03-09-2012).

g. Supporting Steel Structure for 220kV Surge Arrester Drawing No. PDW/TS/4968 (Revision dated 03-09-2012).

h. Typical 220kV Surge Arresters with insulating base Drawing No. PDW/DF/387 (Revision dated 03-09-2012).

i. Typical 500kV Surge Arresters with Supporting Steel Structure Drawing No. PDW/TS/7283 (Dated 03-09-2012).

j. Mono-metallic Terminal Connector Drawing No. PDW/DF-308 (1).

k. Bimetallic Terminal Connector Drawing No. PDW/DF-308 (Revision dated 01-01-2011).

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SCHEDULE OF TECHNICAL DATA
METAL – OXIDE SURGE ARRESTERS WITHOUT GAPS
(FOR 11KV, 33KV, 66KV, 132KV, 220kV & 500KV A.C. SYSTEMS)

Bid/Tender No.----------

Sr. No.	DESCRIPTION			
A.	**General**			
1.	Manufacturer's name & address. (Attach Manufacturer's catalogue with the bid)			
2.	Type/designation of offered surge arrester			
3.	Data of Type Tested Arrester:			
	-	Copy of type test reports attached.	Yes/No.	
	-	Rated Voltage of arrester (Ur).	kV	
	-	Rated Frequency.	Hz	
	-	Continuous operating voltage (Uc).	kV	
	-	Reference voltage of arrester (Uref)	kV	
	-	Nominal discharge current (In).	kA	
	-	Internal partial discharge.	pC	
	-	Line discharge class.		
	-	Pressure relief class.		
	-	Metal-oxide Block Manufacturer's name & address.		
	-	Diameter of Metal-oxide Block	Mm	
	-	Thickness of Metal-oxide Block		
	-	Quantity of Metal-oxide Blocks used in the arrester.	Nos.	
	-	Energy absorption capability,	kJ/kV(Ur),	
4.	**Details of Type Test on Arrester if performed.**		**Date of Test**	**Name of Lab.**
	a.	Lightning Impulse voltage test (dry).		
	b.	Switching impulse voltage test (dry) (For type E & F arresters).		
	c.	Power frequency voltage test (Dry).		
	d.	Power frequency voltage test (Wet).		
	e.	Steep current impulse residual voltage test.		

	f.	Lightning impulse residual voltage test.		
	g.	Switching impulse residual voltage test.		
	h.	Long duration current impulse withstand test.		
	i.	High current impulse operating duty test.		
	j.	Switching surge operating duty test.		
	k.	Short circuit Tests.		
	l.	Tests of arrester disconnectors (For arresters fitted with disconnectors).		
	m.	Artificial pollution test (For porcelain housed multi unit surge arresters).		
	n.	Internal partial discharge test.		
	o.	Seal leak rate test.		
	p.	Current distribution test (For multi column arresters).		
	q.	Bending moment test.		
	r.	Environmental test		
	s.	Radio interference voltage (RIV) test.		
	t.	Moisture ingress test (For polymer housed arresters).		
	u.	Weather ageing test (For polymer housed arresters).		
5.	**Details of Type Test on Surge counter if performed.**		**Date of Test**	**Name of Lab.**
	a.	Shock test as per IEC 60068.		
	b.	Vibration test as per IEC 60068.		
	c.	Temperature test as per IEC 60068.		
	d.	Humidity test as per IEC 60068.		
	e.	Impulse test as per IEC 60099-4.		
	f.	Short-circuit test as per IEC 60099-4.		
	g.	Salt fog test (For polymeric housed arresters).		

B.	**Ratings**			
1.	Highest System Voltage, (Um).		kVrms	
2.	Nominal System Voltage, (Un).		kVrms	
3.	Arrester Minimum Rated Voltage (Ur).		kV rms	
4.	Rated Frequency.		Hz	
5.	Reference Voltage, (Uref)		kVpeak	
6.	Continuous Operating Voltage(COV), (Uc).		kV	
7.	Temporary Over Voltage (TOV), **1s/10s**.		kVrms	
8.	Nominal discharge current (In).		kApeak	
9.	Line discharge class			
10.	Short circuit withstand capability.		kAsym.	
11.	Pressure relief class.			
12.	High Current 4/10 µs Impulse withstand.		kApeak	
13.	Switching Current Impulse Withstand (Upper value).		A	
14.	Max. residual Voltage with 10kA Steep Impulse current wave of 1/20µs.		kV	
15.	Energy absorption capability of arrester.		kJ/kV	
16.	Max. Residual voltage with following lightning impulse current waves of 8/20 µs:			
	-	5 kA, kV peak.		
	-	10 kA, kV peak.		
	-	20 kA, kV peak.		
	-	40 kA, kV peak.		
17.	Max. residual Voltage with following Switching Impulse current wave of 30/60 µs:			
	-	500 A, kVpeak.		
	-	1000 A, kVpeak.		
	-	2000 A, kVpeak.		
	-	3000 A, kVpeak.		

18.	Arrester insulation 1.2/50 µs Lightning Impulse Withstand Voltage, (Dry).		kVpeak	
19.	Arrester insulation Power frequency withstand voltage,			
	-	Dry, kV		
	-	Wet, kV		
20.	Internal partial discharge at 1.05 times continuous operating voltage.		pC	
21.	Highest value of the current in a column of a multi-column arrester.			
22.	Seal leak rate			
23.	Specified long term load (SLL)		Nm.	
24.	Specified short term load (SSL)		Nm.	
25.	Mean Breaking load (MBL)		Nm.	
26.	Power loss at elevated ambient temperature, and with the maximum continuous operating voltage.			
27.	Guaranteed temporary over voltage capability for duration of :			
	-	0.5 sec	kV	
	-	1.0 sec	kV	
	-	3.0 sec	kV	
	-	10 sec	kV	
	-	1.0 min	kV	
	-	20.0 min	kV	
28.	Number of individual units per arrester			
29.	Maximum permissible continuous (leakage) current			
	-	Total continuous current maximum	µ A	
	-	Resistive component of the continuous (leakage) current	Max. µA	
30.	Symmetrical fault current causing operation of pressure relief Device within 1/2 cycle of initiation.		kA	
31.	Internal pressure required to operate pressure relief device, percent of pressure required to burst housing		%	

32	Metal-oxide Resister Block Manufacturer's name & address.		
33.	Outer diameter of Metal-oxide resister blocks used in the arrester.	mm	
34.	Inner diameter of Metal-oxide resister blocks used in the arrester.	mm	
35.	Thickness/height of Metal-oxide resister blocks used in the arrester.	mm	
36.	Quantity of Metal-oxide resister blocks used in the arrester.	Nos.	
37.	Leakage Rate	Torr.	
38.	No. of digits of cyclometer	Nos.	
39.	Minimum operating current of cyclometer	Amp	
40.	Max. high current withstand capability of cyclometer	kA	
41.	Residual voltage at 100kA (4/10 us) of cyclometer	kV	
42.	Switching impulse current withstand of cyclometer	A	
43.	Ammeter scale of cyclometer	mA	
44.	Overall/Total height of arrester	Mm	
45.	Weight of arrester	Kg	
46.	Wind loading capability	kg/sq.m	
47.	Ultimate bending moment	kg-m	
48.	Whether surge arrester is fitted with insulating base ?		
C.	**Construction** (Attach photograph of surge arrester showing all parts and a detail legend with the bid).		
1.	Material of Housing.	Porcelain/ Polymer	
2.	Color of Housing.		
3.	Material of Grading Ring.		
4.	Size of Grading Ring		
5.	Overall Diameter of Grading Ring		

6.	No. of supports for grading ring			
7.	Weight of grading ring including supports.		Kg	
8.	Whether operation counter is without resetting facility?		Yes/No.	
9.	Whether two number earthing terminals at diagonally opposite position shall be provided?		Yes/No.	
D.	**Bushing/Post Insulator**			
1.	Manufacturer's name & address. (Attach Manufacturer's catalogue with the bid).			
2.	Type of Insulator.			
3.	Type tests (Attach copy of type test reports)			
4.	**Details of Type Tests if performed.**		**Date of Test**	**Name of Lab.**
	-	Mechanical test.		
	-	Impulse withstand voltage, peak.	kV	
	-	Power frequency withstand voltage (Dry).	kV	
	-	Power frequency withstand voltage (wet).	kV	
	-	Temperature cycle test on porcelain components		
	-	Porosity test on porcelain components		
	-	Inner pressure test	MPa	
	-	Bending test	kNm.	
	-	Radio interference Voltage.		
5.	Rated Voltage of bushing/insulator.		kV	
6.	Type/Model of bushing/insulator.			
7.	Inner pressure withstand of bushing/insulator.		MPa	
8.	Outer diameter of bushing/insulator.		mm	
9.	Inner diameter of bushing/insulator.		mm	
10.	Shed diameter.		mm	
11.	Height of the bushing/insulator.		mm	
12.	Weight of housing without metal-oxide blocks.		kg.	

13.	Name of polymeric material used (in case of polymeric housing)			
14.	Whether polymeric material is fire-retardant and self extinguishing and is not subject to erosion & ultra violet radiation?		Yes/No.	
15.	No. of units per column.		No.	
16.	Creepage distance (Phase to Earth).		Mm	
17.	Phase to phase clearance.		Mm	
18.	Max RIV at 1 MHz.		µV	
19.	Impulse withstand voltage.		kV	
20.	Power frequency withstand test voltage.			
	a.	Dry 1 minute.	kV	
	b.	Wet 10 sec.	kV	
21.	Ultimate strength of column.		Kg	
22.	Withstand Pressure:			
	a.	Cantilever Strength	N	
	b.	Tensile strength.	N	
	c.	Torsional strength	N	
	d.	Compression strength.	N	
	e.	Bending.	N	
23.	Material of bushing/insulator.			
24.	Color of bushing/insulator.			
25.	Reference Manufacturing Standard.			
E.	**Steel Support Structure**			
1.	Manufacturer's name & address. (Attach drawing/photograph of the support structure with the bid).			
2.	Dimensions for steel support structure:			
	-	Height.	Mm	
	-	Breadth.	Mm	
	-	Width.	Mm	

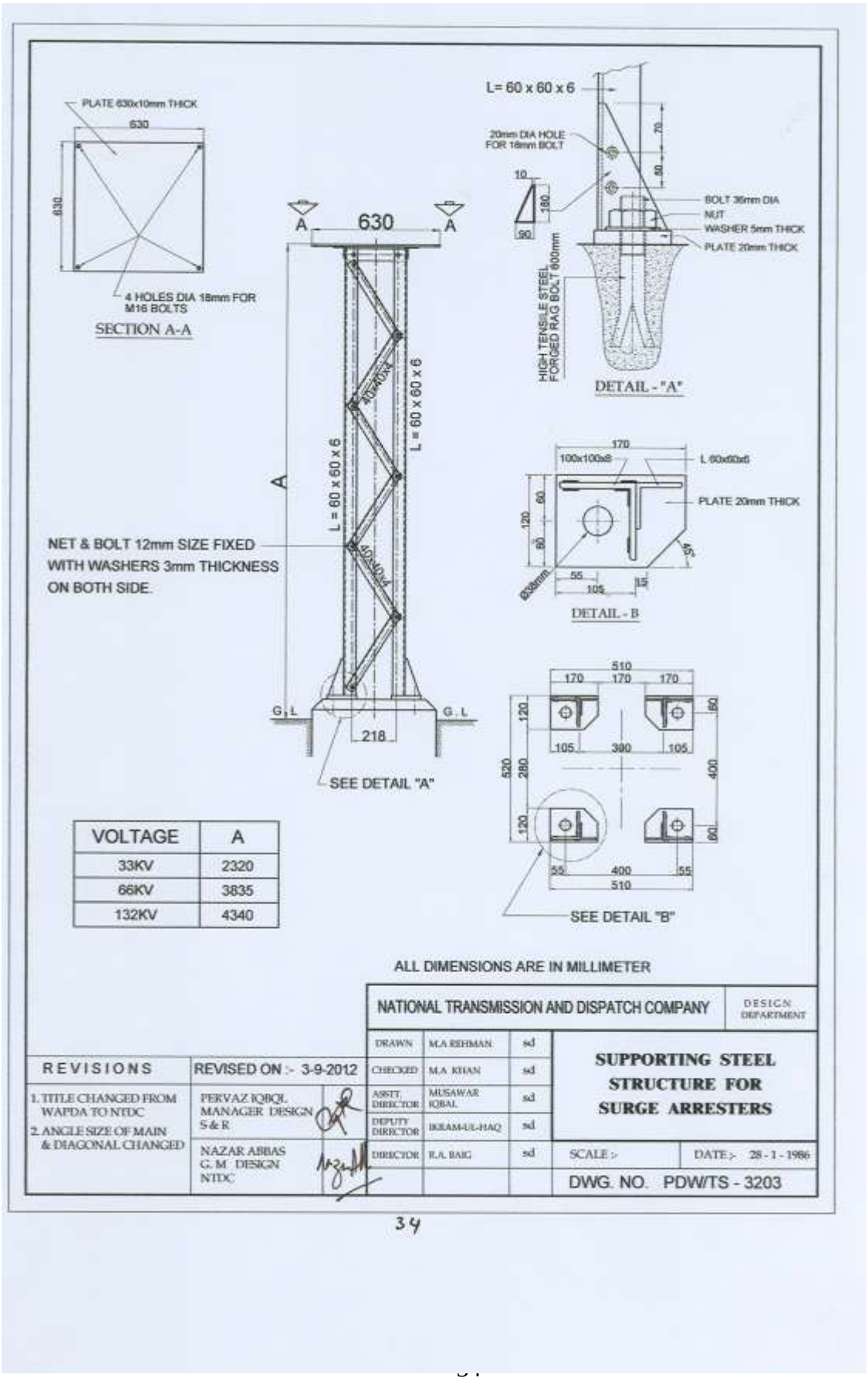
	- Structure fixing foundation details.		
3.	Tensile Strength of Angles/plates.	Kg/mm^2	
4.	Tensile Strength of Nuts & Bolts.	Kg/mm^2	
5.	Yield Strength of Angles/plates.	Kg/mm^2	
6.	Yield Strength of Nuts & Bolts.	Kg/mm^2	
7.	Elongation in 200m guage.	%	
8.	Weight of Zinc Coating of angles/nuts & bolts.		
9.	Thickness of zinc coating angles/nuts & bolts.		
10.	Hardness of nuts & bolts.	HB	
11.	Material of Angles		
12.	Material of Nuts & Bolts with washers		
13.	Diameter & thickness of Washers	mm	
14.	Diameter of bolts.	mm	
15.	Grade of Steel used.		
16.	Whether one flat and one lock washer under each nut is provided?	Yes/No	
17.	Whether 5% extra bolts nuts, lock nuts and washers than actual requirements is provided?		
18.	Weight of zinc coating on angles.	gm/m^2	
19.	Thickness of zinc coating on angles.	mm	
20.	Weight of zinc coating on nuts & bolts.	gm/m^2	
21.	Thickness of zinc coating on nuts & bolts.	mm	
22.	Designed soil bearing capacity.		
23.	Seismic withstand stress/magnitude. (Attach design calculations).		
24.	Total weight of supporting steel structure with foundation bolts.	Kg	

F.	**Terminal**		
1.	Manufacturer's name & address. (Attach drawing/photograph with the bid).		
2.	Material of terminal.		
3.	Size of terminal.		
4.	Current Carrying Capacity of terminal.	A	
5.	Whether two earthing terminals are provided?	Yes/No	
6.	Material of earthing terminal.		
7.	Specified Long term Load (SLL), Nm.	Nm	
8.	Specified Short term Load (SSL), Nm.	Nm	
9.	Mean Breaking Load (MBL), Nm.	Nm	
G.	**Connector**		
1.	Manufacturer's name & address. (Attach drawing/photograph with the bid).		
2.	Type of connector		
3.	Type tests (Attach copy of type test reports).		
4.	Details of Type Tests if performed.	**Date of Test**	**Name of Lab.**
	- Tensile strength & elongation.		
	- Brinell hardness.		
	- Conductivity.		
	- Short circuit withstand.		
	- Heat cycle.		
5.	Material of connector (Monometallic or Bimetallic).		
6.	Material of connector.		
7.	Material of keeper.		
8.	Current carrying capacity of connector.	A	
9.	Tensile Strength of connector.	kg/mm^2	
10.	Tensile Strength of keeper.	kg/mm^2	
11.	Hardness of connector.	HB	
12.	Hardness of keeper.	HB	

13.	Elongation of connector.	%	
14.	Elongation of keeper.	%	
15.	Electrical conductivity of connector.	%	
16.	Electrical conductivity of keeper.	%	
17.	Short Circuit Rating of connector.	kA	
18.	Short Circuit Rating of keeper.	kA	
19.	Material of Nuts & Bolts.		
20.	Tensile Strength of Nuts & Bolts.	Kg/mm^2	
21.	Brinell Hardness of Nuts & Bolts.	HB	
H.	**Name Plates**		
1.	Whether the data as required is marked/ engraved on the name plates?	Yes/No	
2.	Material of name plate.		
3.	Thickness of name plate.	mm	

****

SIGNATURE AND STAMP OF MANUFACTURE



VOLTAGE	A
33KV	2320
66KV	3835
132KV	4340

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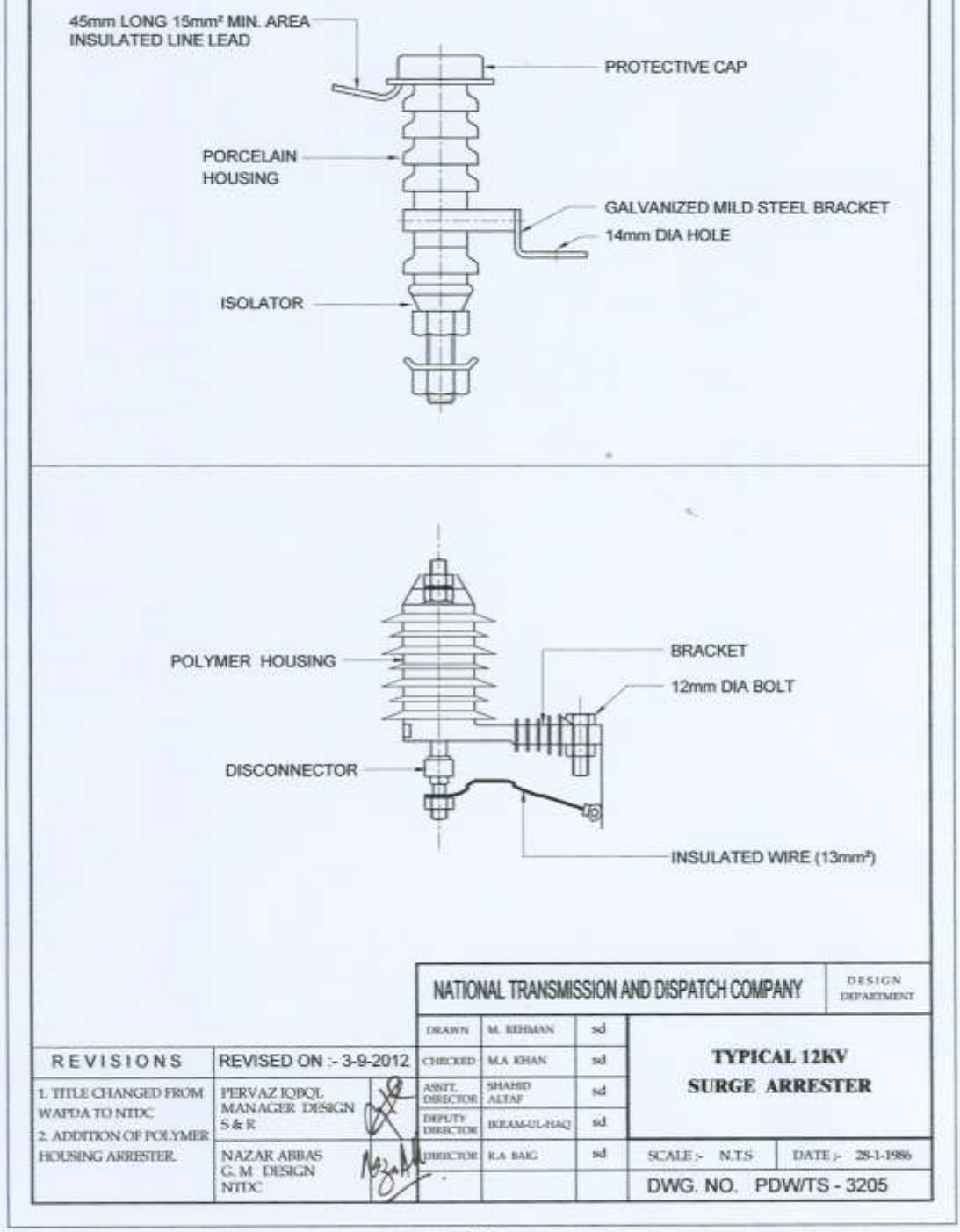

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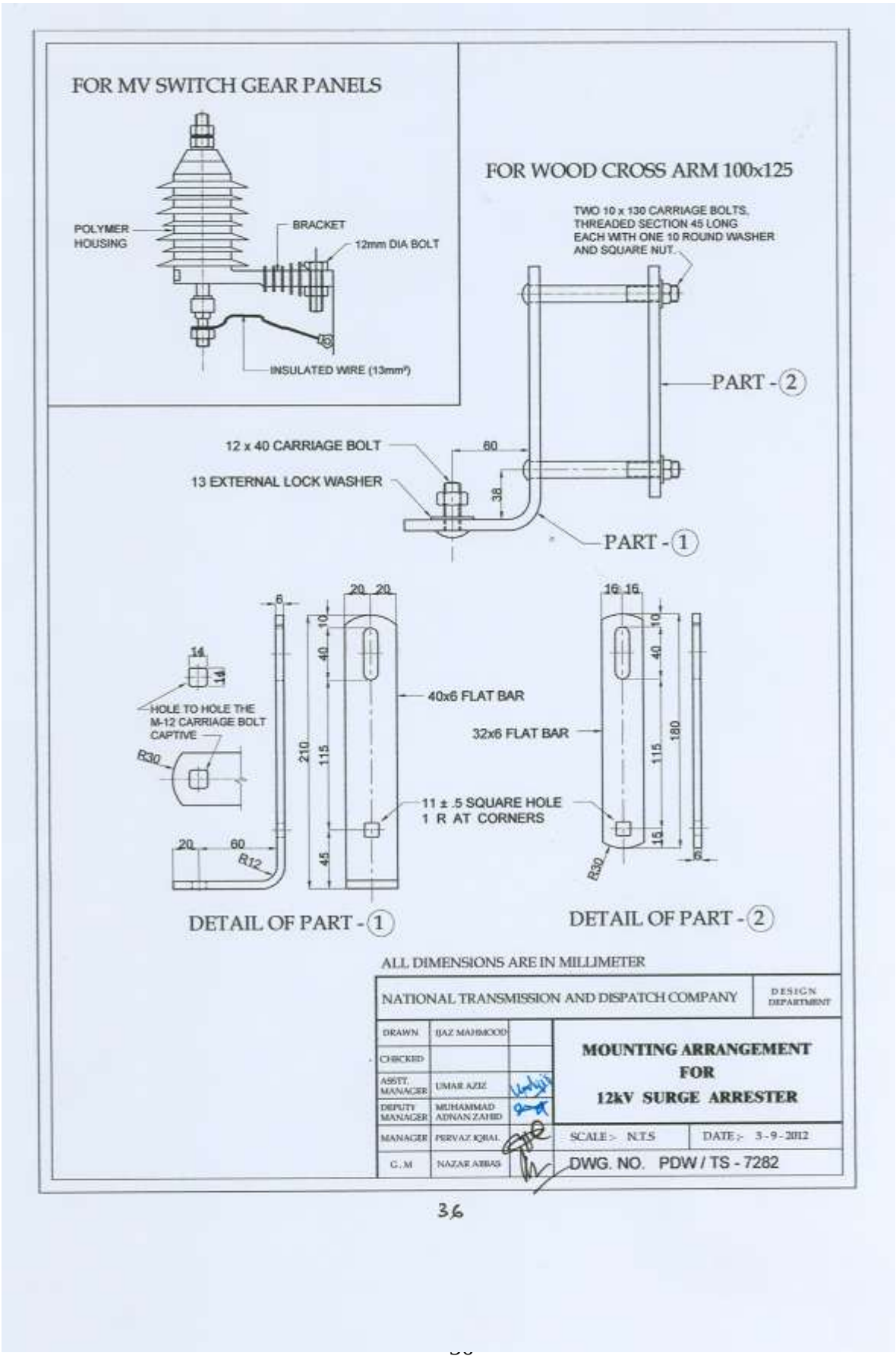

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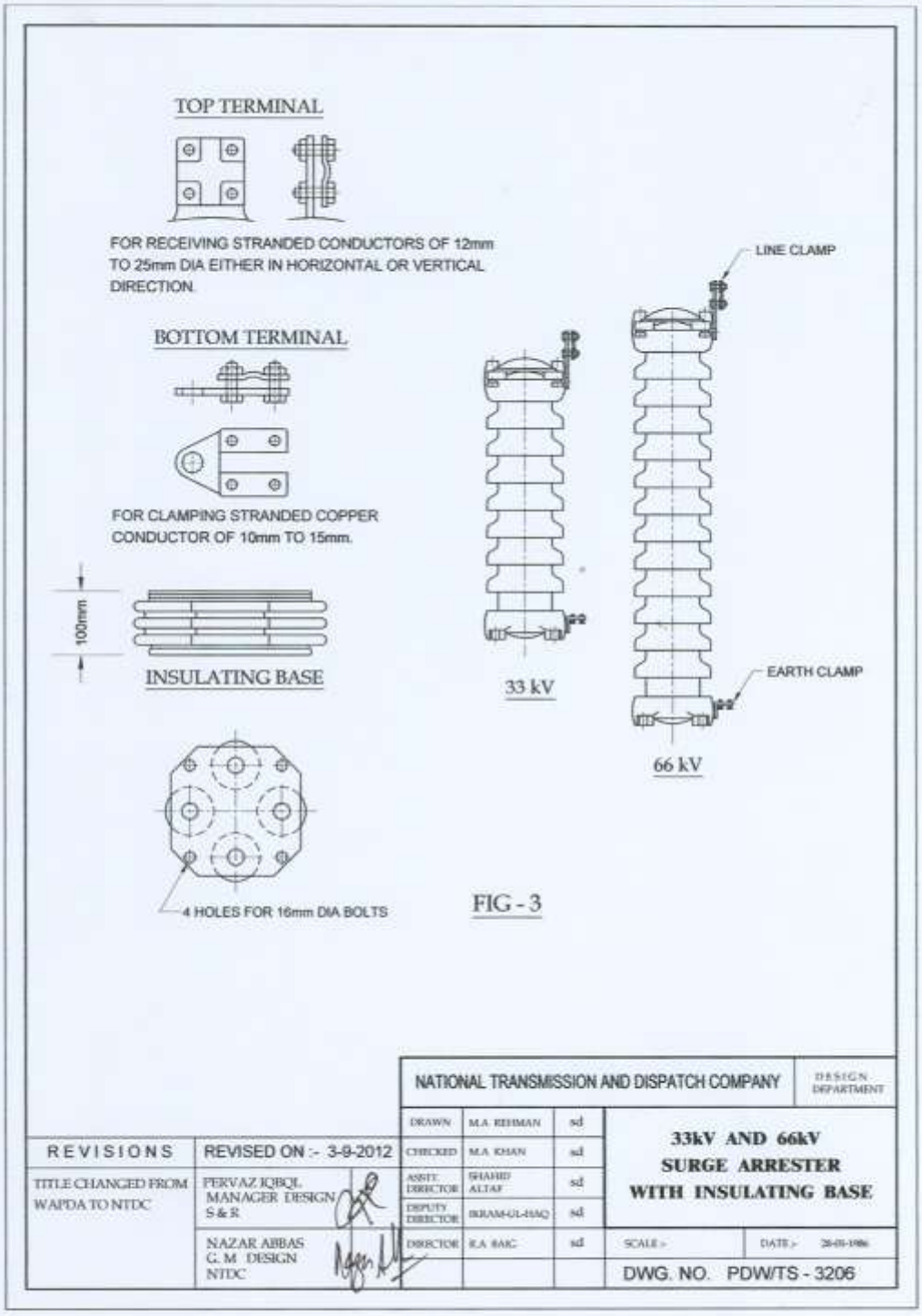

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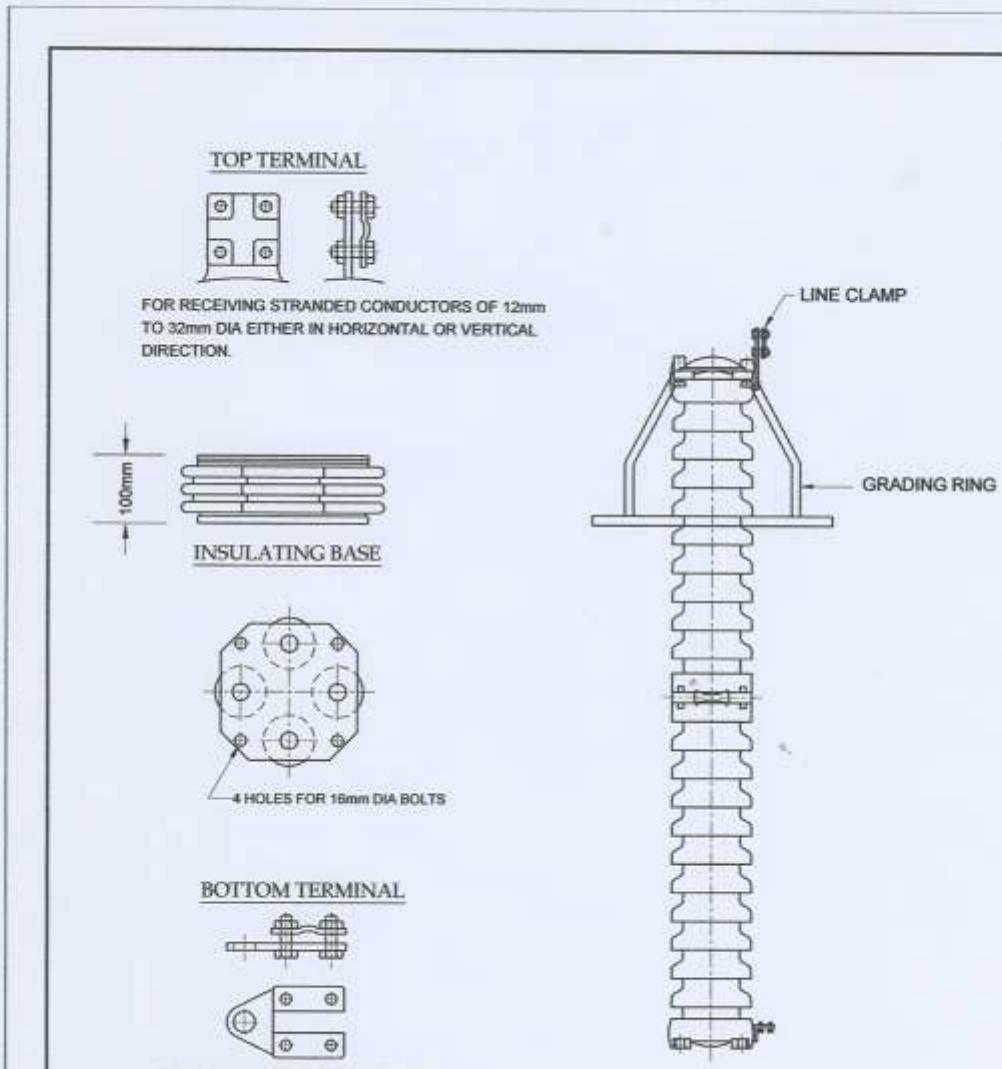
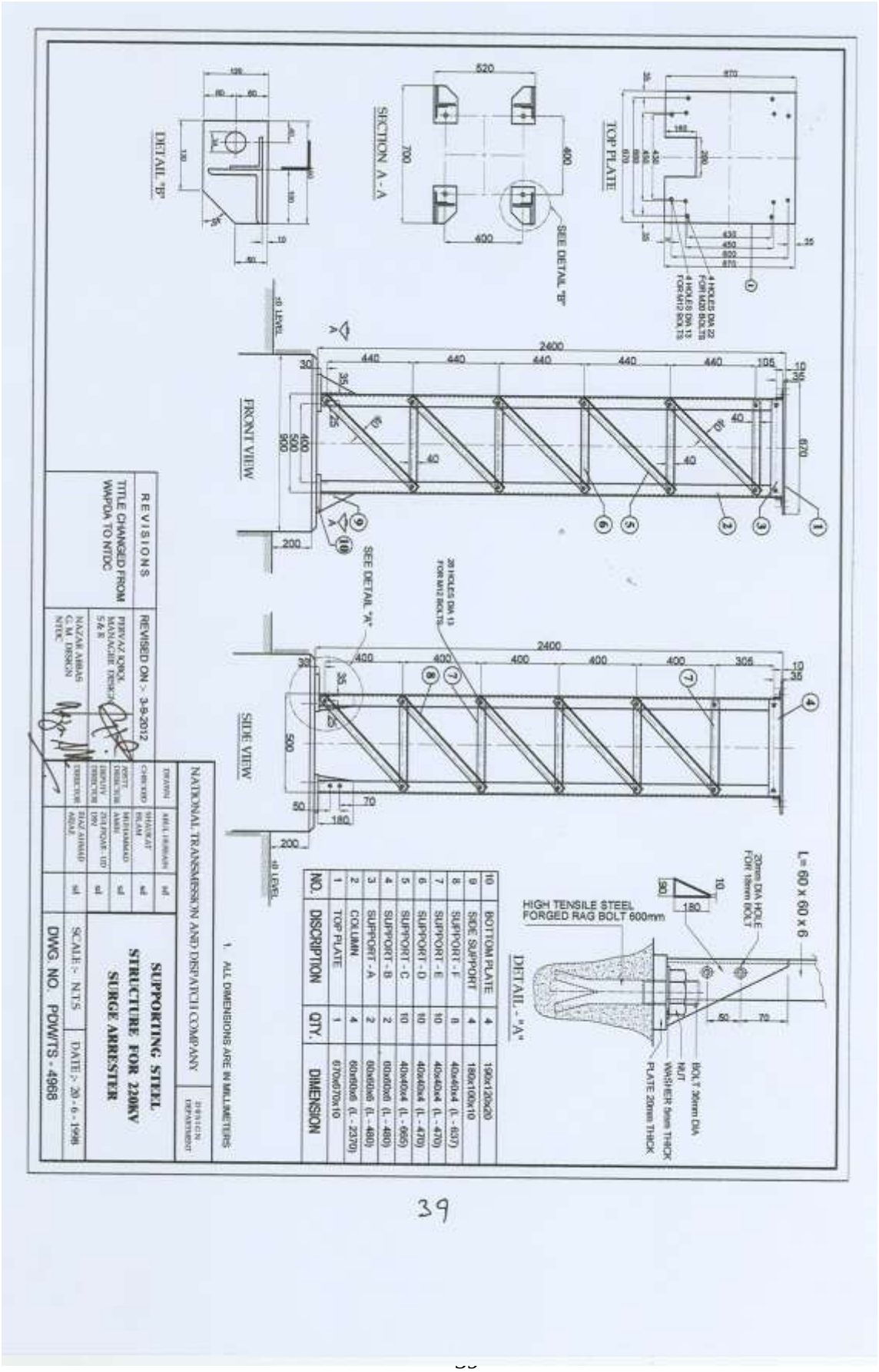


FIG - 4

NATIONAL TRANSMISSION AND DISPATCH COMPANY			DESIGN DEPARTMENT
	DRAWN: M.A REHMAN	sd	132kV SURGE ARRESTER WITH INSULATING BASE
REVISIONS	CHECKED: M.A KHAN	sd	
REVISED ON :- 3-9-2012	ASSTT. MANAGER: SHAHID ALTAF	sd	
TITLE CHANGED FROM WAPDA TO NTDC	DEPUTY MANAGER: IKRAM-UL-HAQ	sd	
PERVAZ IQBQL MANAGER DESIGN S & R	MANAGER: R.A BAIG	sd	SCALE:- DATE:- 28-1-1986
NAZAR ABBAS G. M DESIGN NTDC			DWG. NO. PDW/TS - 3207



NO.	DISCRIPTION	QTY.	DIMENSION
10	BOTTOM PLATE	4	190x120x20
9	SIDE SUPPORT	4	180x100x10
8	SUPPORT - F	8	40x40x4 (L - 637)
7	SUPPORT - E	10	40x40x4 (L - 470)
6	SUPPORT - D	10	40x40x4 (L - 470)
5	SUPPORT - C	10	40x40x4 (L - 665)
4	SUPPORT - B	2	60x60x6 (L - 480)
3	SUPPORT - A	2	60x60x6 (L - 480)
2	COLUMN	4	60x60x6 (L - 2370)
1	TOP PLATE	1	670x670x10

1. ALL DIMENSIONS ARE IN MILLIMETERS

NATIONAL TRANSMISSION AND DISPATCH COMPANY

DESIGN DEPARTMENT

REVISIONS	REVISED ON :- 3-8-2012
TITLE CHANGED FROM WAPDA TO NTDC	PERVAZ KHOL MANAGER DESIGN S & R

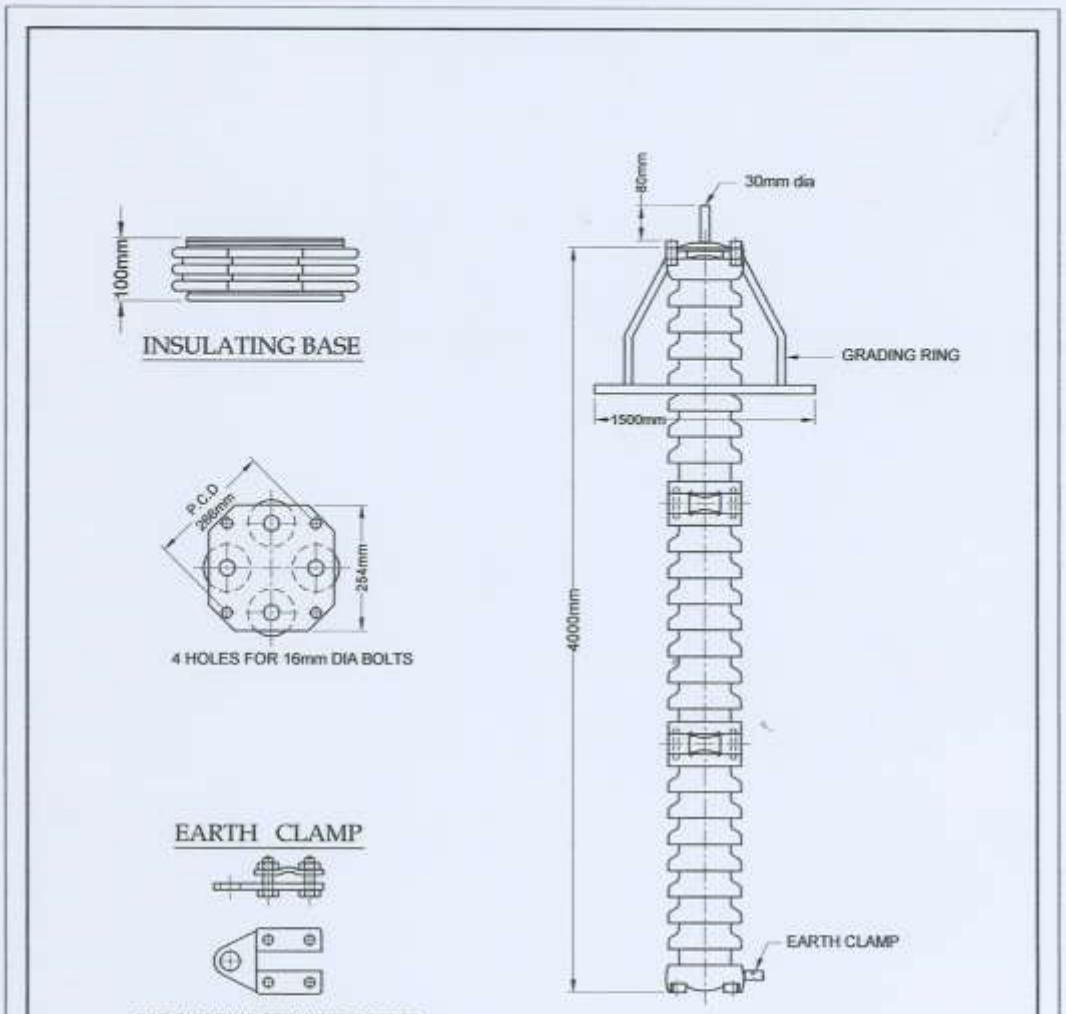
NAZAR ABBAS G.M. DESIGN NTDC

	DRAWN	CHECKED	POST DIRECTION	DEPUTY DIRECTION	DIRECTION
	ABUL HASNAIN	SHAHZAT ISLAM	MUHAMMAD AMIN	ZULFQAR UD DIN	RIAZ AHMAD ABAD
	sd	sd	sd	sd	sd

SUPPORTING STEEL STRUCTURE FOR 220KV SURGE ARRESTER

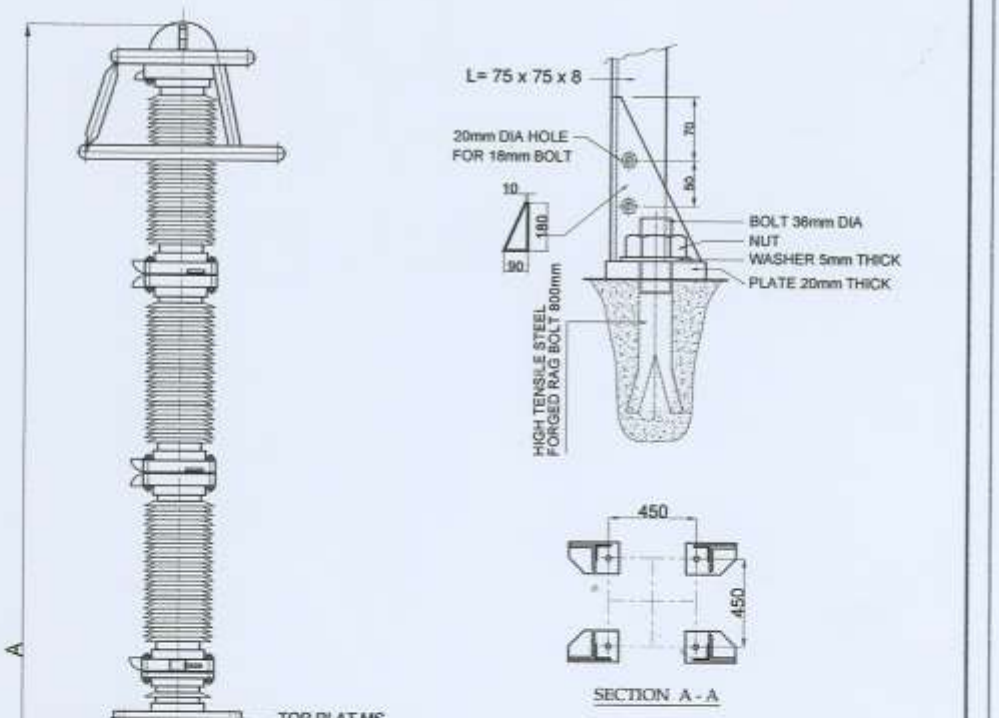
SCALE :- NTS | DATE :- 20 - 6 - 1998

DWG. NO. PDWTS - 4968



		NATIONAL TRANSMISSION AND DISPATCH COMPANY			DESIGN DEPARTMENT
		DRAWN	IJAZ MAHMOOD	sd	TYPICAL 220kV SURGE ARRESTER WITH INSULATING BASE
REVISIONS	REVISED ON :- 3-9-2012	CHECKED	A. LATIF	sd	
1. TITLE CHANGED FROM WAPDA TO NTDC	PERVAZ IQBAL MANAGER DESIGN S & R	ASSTT. DIRECTOR	M. ANWAR	sd	
		DEPUTY DIRECTOR	CAPT. ZULFIQAR AHMED	sd	
	NAZAR ABBAS G. M. DESIGN NTDC	DIRECTOR	M. ASLAM IQBAL	sd	SCALE :- DATE :- 6-4-1986
		CHIEF ENGINEER	SHAHBB-UD-DIN		DWG. NO. PDW/DF - 387

40



DISCRIPTION	A - TOTAL HEIGHT OF SURGE ARRESTER & STEEL STRUCTURE
FOR LINE SURGE ARRESTER	9000 mm
FOR TRANSFORMER SURGE ARRESTER	11000 mm

NOTES :-

THE SIZE / DIMENSIONS FOR STEEL STRUCTURE ARE FOR GUIDANCE ONLY. THE MANUFACTURER MAY SUPPLY AS PER HIS OWN DESIGN SUBJECT TO APPROVAL BY THE ENGINEER.

NATIONAL TRANSMISSION AND DISPATCH COMPANY		DESIGN DEPARTMENT
DRAWN	IJAZ MAHMOOD	TYPICAL 500kV SURGE ARRESTER WITH SUPPORTING STEEL STRUCTURE
CHECKED		
ASSTT. MANAGER	UMAR AZIZ	
DEPUTY MANAGER	MUHAMMAD ADNAN ZAHID	
MANAGER	PERVAZ IQBAL	SCALE :- N.T.S / DATE :- 3-9-2012
G.M	NAZAR ABBAS	DWG. NO. PDW/TS - 7283

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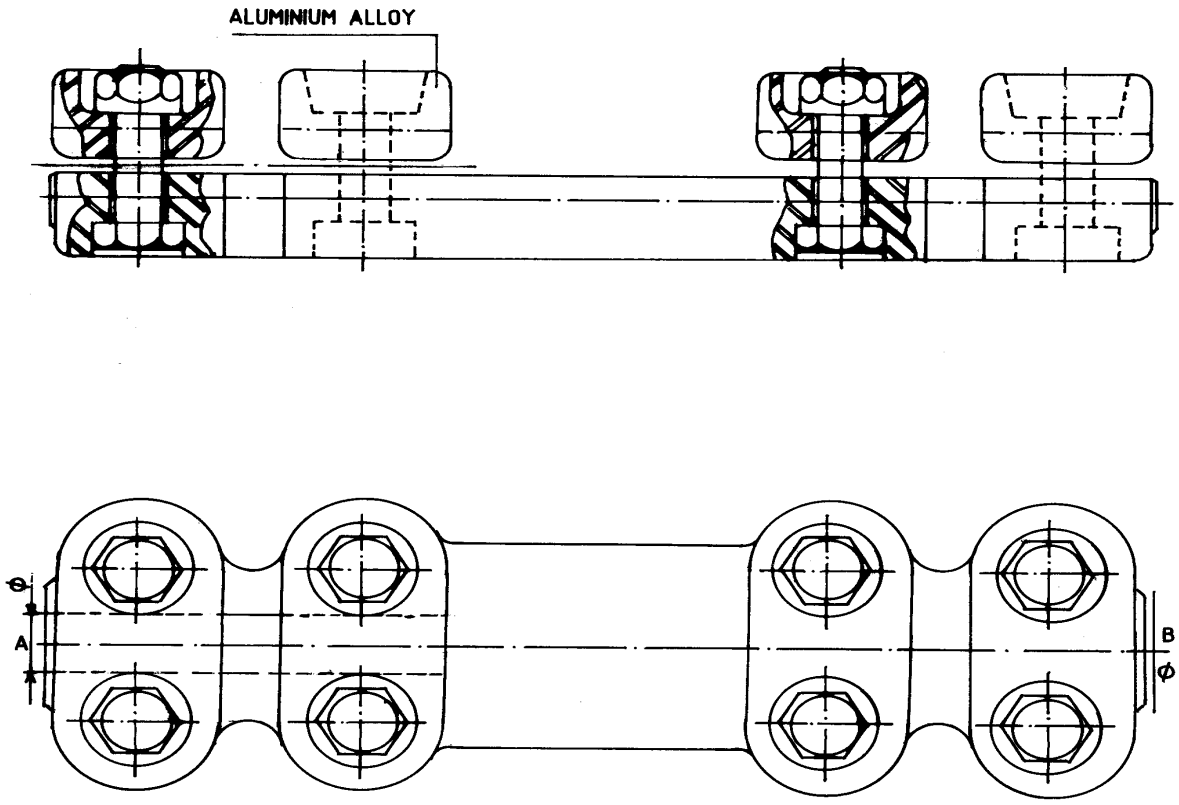


TYPE DESIGNATION	A	B
OMA	20 - 26	30 - 40
OMH	28 - 32	30 - 40
OMC	30 - 38	30 - 40

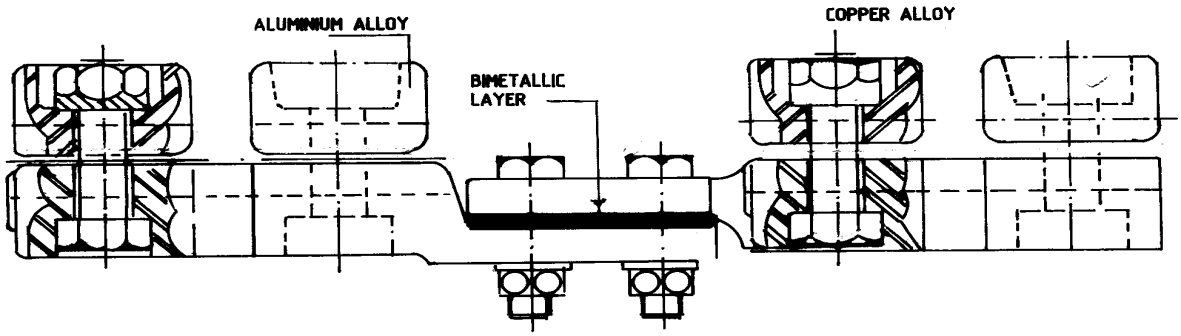
NOTES.

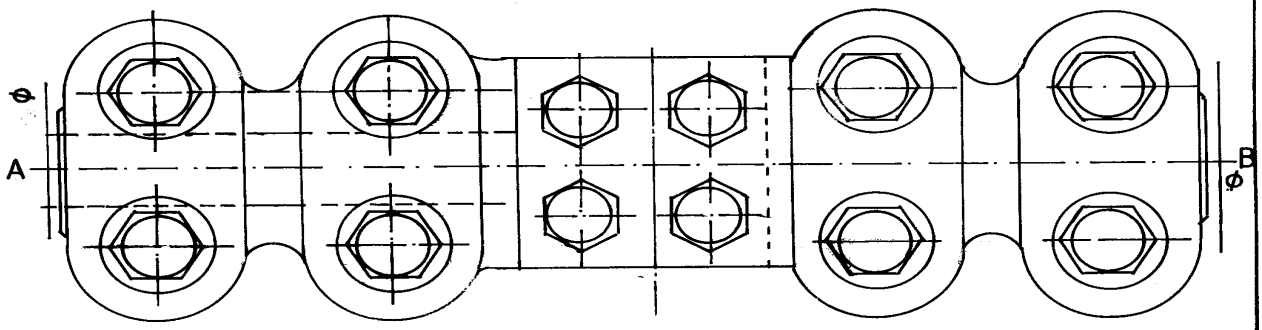
1 - ALL DIMENSIONS ARE IN MILLIMETERS.

2 - BODY MANUFACTURED IN ALUMINIUM ALLOY.

3 - THIS DRAWING IS FOR GUIDANCE ONLY.

NATIONAL TRANSMISSION AND DISPATCH COMPANY			DESIGN DEPT. (NTDC)
REVISIONS	REVISED ON: 01-01-2011	TRACED	S. M. ASGHAR
.1 - TITLE CHANGED FROM WAPDA TO NTDC.	PERVAZ IQBAL MANAGER DESIGN (S&R)	CHECKED	GHULAM RASUL
2 - TYPE DESIGNATION CHANGED AS OMA, OMH AND OMC.	NAZAR ABBAS CHIEF ENGINEER DESIGN (NTDC)		A. HAMEED
			ABDUL SAMI
		DIRECTOR	A.M. KAZMI
		CHIEF ENGINEER	JAVID AKHTAR
STRAIGHT MONOMETALIC CONNECTOR (BOLTED TYPE)			
SCALE . N. T. S.	DATE.		
DWG. NO. PDW/DF - 388(1)			





TYPE DESIGNATION	A	B
OBA	AL 20 - 26	CU 30 - 40
OBH	AL 28 - 32	CU 30 - 40
OBC	AL 30 - 38	CU 30 - 40

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. BODY MANUFACTURED IN AL-ALLOY AND COPPER ALLOY.
3. THIS DRAWING IS FOR GUIDANCE ONLY.

NATIONAL TRANSMISSION AND DESPATCH COMPANY | DESIGN DEPT:(NTDC)

REVISIONS	REVISED ON:01-01-2011				
1. TITLE CHANGED FROM WAPDA TO NTDC.	PERVAZ IQBAL MANAGER DESIGN (S & R)		TRACED	S.M. ASGHAR	
2. TYPE DESIGNATION CHANGED AS OBA, OBH & OBC.	NAZAR ABBAS CHIEF ENGINEER DESIGN (NTDC)		CHECED	GHULAM RASUL	
			JUNIOR ENGINEER	A. HAMEED	
			DEPUTY DIRECTOR	ABDUL SAMI	
			DIRECTOR	A.M.KAZI	
			CHIEF ENGINEER	JAVID AKHTAR	

STRAIGHT BIMETALLIC CONNECTOR (BOLTED TYPE)

SCALE:- N.T.S | DATE:- 09-4-1980

DWG: NO. PDW/DF 308

SPECIFICATION TLMS-8A:2017

DESIGN (T/LINE) DEPARTMENT

NTDC

NON CERAMIC COMPOSITE INSULATORS FOR OVERHEAD TRANSMISSION LINES 132KV/220KV/500KV

PREPARED BY	REVIEWED BY	APPROVED BY
Manger Design, NTDC	G.M. (GSC) NTDC G.M. (GSO) NTDC G.M. (Services Division) NTDC G.M. (Technical) NTDC	Managing Director NTDC
Approved vide: Managing Director NTDC noting no.1594 dated 27.04.2017		

S.NO.	REVISION	DATE

TABLE OF CONTENTS

SPECIFICATION TLMS-8A:2016

Non Ceramic Composite Insulators,
For Overhead Transmission Lines 132KV/220KV/500KV

1.0 SCOPE

1.1 This specification specifies minimum technical requirements for design, engineering, manufacture, inspection, testing, performance and preparation for delivery of non-ceramic composite insulators for use in overhead transmission line system of National Transmission & Despatch Company (NTDC), Pakistan and DISCOs.

1.2 Non ceramic composite insulators shall be of following types:

Composite Long Rod Insulators for conductor tension and suspension application for system voltages rated 132kV, 220kV and 500kV.

2.0 DEFINITIONS

Core - The internal part of a composite insulator. The core is the mechanical load-bearing component of the insulator. The core consists mainly of glass fibers impregnated with a resin based matrix so as to achieve maximum strength. Also called a fiberglass-reinforced plastic (FRP) rod.

Type Tests - Tests to evaluate the electrical and mechanical design characteristics of the non-ceramic composite insulator which depend mainly on its shape and size. Also, these tests evaluate and verify the suitability of materials, interfaces, prototype design, and method of manufacture. These tests are performed only once and are considered valid for the whole class of insulators represented.

End Fittings, Metal - The metal attachment hardware that is connected to the insulator core that transmits the mechanical loads to the core at the ends of the insulator.

EPDM (Ethylene Propylene Diene Monomer) - Commonly used as a base polymer in non-ceramic composite insulator rubber formulations.

EPR (Ethylene Propylene Rubber) - The generic term that includes both EPDM and EPM.

Grading Device - A device for controlling the potential gradient at the end fittings.

Housing - The insulator component which is external to the core and contains both a sheath and weathersheds. The sheath–weathershed system protects the core and provides the required leakage distance.

Mechanical Load Test - A mechanical test for non-ceramic composite suspension insulators used to determine if a lot of insulators meet the Specified Mechanical Load (SML) requirements. The historical failure loads from this test justify the manufacturer's choice of SML. Mechanical testing is also performed on every insulator to check its Routine Test Load (RTL) rating.

Non-Ceramic Composite Insulator - An insulator unit that is made from material other than porcelain, glass, or other ceramic material. It consists of a load-bearing resin-impregnated fiberglass core, metal end fittings, and external elastomeric housing.

Sample Tests/Factory Acceptance Tests (FATs) - Destructive or nondestructive tests that are used to verify insulator conformance to specific characteristics, quality of manufacture and determine acceptability of an insulator lot.

Routine Test - A test performed on every insulator from each lot to identify insulators with manufacturing defects by the manufacturer himself.

Routine Test Load (RTL) - The load applied to non-ceramic composite suspension insulators that is equal to or greater than 50 percent of the insulator Specified Mechanical Load (SML) rating. Also, considered to be the maximum continuous working load of the insulator.

Silicone Rubber (SR) - Usually in the form of polydimethylsiloxane, it is used as a base polymer in non-ceramic composite insulator rubber formulations. It is known for its hydrophobic (water-repellent) properties.

Specified Mechanical Load (SML) - A load specified by the manufacturer that represents the ultimate strength of a non-ceramic composite suspension insulator under tension. The strength should be verified during Mechanical Load Tests, and the historical failure loads should justify the manufacturer's choice of SML. It forms the reference point for selection of a non-ceramic composite suspension insulator. It is not the maximum working load of the insulator (see RTL). The SML of an insulator may be reduced by the class of hardware used for the end fittings.

Ultimate Strength - An insulator's tensile, compressive, or cantilever loading at which any part of the insulator fails to perform its function of providing mechanical support. Damage to the insulator core is likely to occur at loads lower than the insulator failing load.

Weathershed - The part of the insulator's housing which protrudes from the sheath and used to provide added leakage distance.

3.0 APPLICABLE CODES AND STANDARDS

The latest revision/amendments of the following Codes and Standards shall be applicable for the equipment/material covered in this Specification. In case of conflict, the bidder/manufacturer may propose equipment/material conforming to one group of Industry Codes and Standards quoted hereunder without jeopardizing the requirements of this specification.

ANSI C29.1 Standard Test Methods for Electrical Power Insulators

ANSI C29.2 Insulators, Wet-Process Porcelain and Toughened Glass, Suspension Type

ANSI C29.11 Composite Suspension Insulators for Overhead Transmission Line-Tests

ANSI C29.12 Insulators - Composite - Suspension Type

NEMA 107 Methods of Measurement of Radio Influence Voltage (RIV) of High Voltage Apparatus

IEEE Std. 4 High Voltage Testing Techniques

IEEE Std. 957 IEEE Guide for Cleaning Insulators

IEEE Std. 987 IEEE Guide for application of Composite Insulators

IEC 60383-1 Insulators for Overhead Lines with a Nominal Voltage above 1000V - Part 1: Ceramic or Glass Insulator Units for A.C. Systems - Definitions, Test Methods and Acceptance Criteria

IEC 60383-2 Insulators for Overhead Lines with a Nominal Voltage above 1000V - Part 2: Insulator Strings and Insulator Sets for A.C. Systems - Definitions, Test Methods and Acceptance Criteria

IEC 60507 Artificial Pollution Tests on High Voltage Insulators to be used on A.C. Systems

IEC 60587 Test methods for evaluating resistance to tracking and erosion of electrical insulating materials used under severe ambient conditions

IEC 61109 Composite Insulators for A.C. Overhead Lines with a Nominal Voltage greater than 1000V - Definitions, Test Methods and Acceptance Criteria

IEC 61466-1 Composite String Insulator Units for Overhead Lines with a Nominal Voltage greater than 1000V - Part 1: Standard Strength Classes and End Fittings

IEC 61466-2 Composite String Insulator Units for Overhead Lines with a Nominal Voltage greater than 1000V - Part 2: Dimensional and Electrical Characteristics

IEC 62217 Polymeric insulators for indoor and outdoor use with a nominal voltage greater than 1 000 V – General definitions, test methods and acceptance criteria

IEC 61467 Insulators for overhead lines with a nominal voltage above 1000V AC power arc tests on insulator sets

IEC TS 62073 Guidance on the measurement of wettability of insulator surfaces

IEC 60437 Radio Interference Test on High-Voltage Insulators

IEC 60815 Selection and Dimensioning of High-Voltage Insulators intended for use in Polluted Conditions

IEC 60060 High Voltage Test Techniques

IEC 60120 Dimensions of Ball and Socket Couplings of String Insulator Units

IEC 60471 Dimensions of Clevis and Tongue Couplings of String Insulator Units

ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM B499 Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method; Nonmagnetic Coatings on Magnetic Basis Metal

ASTM D2240 Test Method for Rubber Property—Durometer Hardness

This specification shall also be read in conjunction with Purchase Order or Contract Schedules for project, as applicable.

The manufacturer will provide purchaser with latest editions of the above listed applicable standards. It is the responsibility of the manufacturer to provide copies of latest editions of above mentioned standards to the Inspector at least two (02) weeks prior to start of testing.

4.0 DESIGN REQUIREMENTS

The design, fabrication, material, processes, tolerances and inspection of composite insulators shall conform to the following:

4.1 General

4.1.1 Language and Units: All correspondence, literature, drawings and markings shall be in English language. All dimensions shall be in SI units (Metric System).

4.1.2 The composite insulators shall be of manufacturer's standard design but shall meet or exceed the requirements of this specification in all respects.

4.1.3 The manufacturer's design drawings shall show the outline of the composite insulators, together with all pertinent dimensions and ratings. Any variations in these dimensions due to manufacturing tolerances shall be indicated.

4.1.4 The drawings shall include principal dimensions (i.e. length, core diameter, leakage distance, dry arc distance, number of sheds, diameter of weathersheds and weathersheds spacing, details of end fittings and corona rings) and shall be representative of the actual shed profile.

4.1.5 The drawings shall also include the basic mechanical and electrical characteristics of insulator, approximate weight of one insulator unit, type of the material used for the sheath and weathersheds and the material of the corona rings and end fittings.

4.2 Design Criteria

4.2.1 The composite insulator weathershed design shall be aerodynamic type with good self-cleaning properties without any under ribs. Insulator shed profile, spacing, projection and selection in respect of polluted conditions shall be in accordance with recommendation of IEC 60815.

4.2.2 The composite insulator couplings i.e. ball & socket / tongue & clevis, must be IEC compatible.

4.2.3 The maximum diameter of the composite insulator weathershed shall be 200mm.

4.2.4 Services conditions as specified in the Purchase Order or Contract Schedules shall serve as the basis of design criteria and shall be provided by the purchaser as attached in Annexure-I.

4.3 Ratings

4.3.1 The composite insulators shall have the Voltage Class, SML strength ratings and coupling types as listed in Table-I below:

Table-I

Nominal System Voltage (kV)	Coupling (IEC 60120/60471)	Specified Mechanical Load (SML)		Min. Leakage Distance (mm)	Maximum Permissible Section Length (mm)
		Suspension Application (kN)	Tension Application (kN)		
132	Ball & Socket	80 80 80	- -	3888 4752 5616	1314 1606 1898

		- -	100 100 100	3888 4752 5616	1314 1606 1898
220	Ball & Socket	100 -	100 160	6480 6540	2190 2136
500	Tongue & Clevis	80 80 80 80 160 160 160 160	- - - - 160 160 160 160	12528 15984 19872 23328 12535 16350 19620 23435	4234 5402 6716 7884 4094 5340 6408 7654

Notes:

i. Maximum permissible section lengths are given in the above table. Nominal section lengths corresponding to above leakage distance requirements/insulation levels shall be provided by the manufacturer.
ii. The tolerances specified in IEC 61109 are applicable to the nominal length.
iii. The required mechanical and electrical strength and type of string; I-suspension (single/double suspension), V-suspension and tension string (single/double/triple/quad tension) shall be specified in the data schedule.
iv. For replacement of existing porcelain disc insulator strings with non-ceramic composite insulators, the bidder/manufacturer shall ensure the compatibility of end fittings with the line hardware whilst satisfying all the requirements of this specification.

4.3.2 The electrical withstand values of composite insulators shall be in accordance with Annex-I. The electrical withstand values shall be met with corona rings installed on the line end of the insulators.

4.3.3 The maximum radio-influence voltage (RIV) shall be 100 microvolts at 1000 kHz.

4.3.4 The composite insulator's Mechanical and Electrical characteristics shall be as specified in Data Schedule given in this specification.

4.3.5 The composite insulators shall have hydrophobicity of silicone rubber material classified Wettability Class 1 (WC-1) or better per IEC 62073. Accordingly, receding water contact angle shall be 80° or more.

4.4 **Material and Workmanship**

4.4.1 The complete composite insulator shall consist of a Fiberglass Reinforced Plastic (FRP) core having superior electrical and mechanical performance, sheath (housing), weathersheds and metal end fittings.

4.4.2 The composite insulator surface shall be shaped and spaced for effective natural cleaning and effective use of leakage distance for coastal/desert/humid/industrially polluted and other environments as mentioned in service conditions by the purchaser.

4.4.3 The composite insulators shall be fabricated through one of the following processes:

a. High Temperature Vulcanized (HTV) Silicone Rubber Insulators, Single-Piece Molded Design

The housing (sheath and weathersheds) shall be directly applied on to the FRP core in one single-step (compression molding) through high temperature vulcanization process. Any seams/burrs protruding axially along the insulator resulting from this process, shall be removed completely. Injection molding is acceptable only in case the housing is molded in one single-shot. Molding in multiple steps may cause flaws and the residual stress in the joining seams and, therefore, shall not be acceptable.

b. High Temperature Vulcanized (HTV) Silicone Rubber Insulator, Modular Design

A sheath shall be extruded seamlessly on to the FRP core. The housing shall be completed by assembly of molded weathersheds on to the sheath. All parts of the insulating body, i.e., FRP core, sheath and the weathersheds shall be bonded together by high temperature vulcanization.

c. Liquid Silicone Rubber (LSR) Insulators

Full size, one -piece insulator housing (sheath and weathersheds) shall be produced in one molding step by applying low viscosity liquid silicone rubber with low silica filler content.

4.4.4 The insulators shall be of appropriate length to provide the required leakage distance and the electrical performance in one single unit. In-line coupling of two or more units shall not be acceptable. No radial joints shall be made along the length of the sheath regardless of the distance between the end fittings. The sheath shall be extended inside the end fittings to protect and hermetically seal the fiberglass core from moisture. The interface between the FRP core and the end fitting shall be sealed to effectively eliminate the possibility of moisture ingress for the life of the insulator.

4.4.5 The composite insulators shall be capable of withstanding high pressure power washing. To prove this property, a power wash test shall be performed per Clause 5.5.3. The manufacturer will define washing intervals for insulators considering site contamination severity and required pollution performance along with specific washing consideration required to be followed to protect insulators from mechanical damage.

4.4.6 The composite insulators shall be capable of withstanding the power arc test, followed by radio influence and corona tests and finally verification of residual mechanical strength.

The insulators shall be compatible for use with hot line or live line maintenance techniques so that usual hot line operations can be carried out with ease, speed and safety and the manufacturer will furnish the method of hot and cold line maintenance.

4.4.7 Core

4.4.7.1 The internal core shall be a glass-fiber reinforced FRP rod consisting of E-glass fibers and epoxy based resin.

4.4.7.2 To reduce risk of brittle fracture the insulator FRP core shall be made of electrical corrosion resistant (ECR) boron free glass rod and shall achieve the specified electrical and mechanical characteristics. The FRP core shall be resistant against hydrolysis under service conditions.

4.4.7.3 During fabrication of the glass core, the glass strands in the insulator core shall not be allowed to touch one another without resin matrix surrounding each individual fiber. Fibers shall be continuous between rod ends and oriented parallel to the rod axis. Glass content shall equal or exceed 60 percent by volume of the fiberglass-epoxy mixture. All areas in the rod not occupied by fiberglass strands shall be filled with epoxy. All fiberglass strands and epoxy shall be fully bonded together.

4.4.7.4 The composite insulator core shall be mechanically and electrically sound, free from voids, foreign substances, and manufacturing flaws. The design shall be such as to ensure that the core is totally encapsulated and fully sealed, from the live end to earthed ends, by the insulating material from the environment, in order to avoid ingress of moisture. If any tacky substances are used as sealers, they shall not be exposed to environmental influence.

4.4.7.5 The core shall have the same diameter throughout the entire length of the rod. Long composite insulators bend easily due to their own flexibility by a small load during transportation, handling, installation, etc., and an excessive bending has a danger of damaging the core. To avoid any risk of damage, FRP core shall have a minimum of Φ24mm diameter for 500kV applications which shall prevent such excessive bending. To verify the suitability of the FRP core diameter a bending test shall be performed in accordance with acceptable industry practice. The manufacturer shall submit the necessary details for review and acceptance by purchaser.

4.4.7.6 The insulator unit shall possess the required compression strength for application in vee-string configuration and torsional strength for application in horizontal tension string configuration to prevent damage during the construction and operation phases. The manufacturer shall provide the maximum permissible limits of these strengths.

4.4.8 Housing

4.4.8.1 The core of composite insulator shall be completely covered by a continuous housing consisting of a sheath-weathershed system.

4.4.8.2 The composite insulator sheath and weathersheds insulating material shall have a chemical structure of 100 percent silicone rubber before fillers are added. The finished product shall be ultraviolet (UV) radiation exposure resistant. The finished product shall be unaffected by atmospheric conditions due to weather, proximity to the coast, fumes, ozone, acids (particularly sulphuric acid present in the prevailing environment of oil field areas in the region), alkalies, dust or rapid changes to air temperature. There shall be no material degradation such as development of surface cracks and increase in surface hardness, etc.

4.4.8.3 The weathersheds and sheath shall be bonded together during the vulcanization process or molded into one piece by injection/compression molding. The sheath shall be bonded to the rod or have a void-free silicone interface. The housing shall be bonded to the metal end fittings or be properly sealed to prevent moisture or contaminant ingress to the FRP rod. The housing shall fully protect the fiberglass rod for the service life of the insulator. The housing shall be smooth and free from imperfections. There shall be no holes or gaps in the housing at any point along the length of the insulators.

4.4.8.4 The strength of the silicone rubber to FRP core and weathershed to sheath interface shall be greater than the tearing strength of the silicone rubber.

4.4.8.5 The composite insulators thickness of the sheath or weathershed covering over the core shall be greater than 3.0 mm. The sheath-weathershed should have silicone content minimum 30% by weight.

4.4.8.6 The track resistance of the sheath and weathersheds material shall meet the requirements of IEC 60587 method 1 class 1A4.5.

4.4.8.7 The sheath and weathersheds material of insulators fabricated from high temperature vulcanized silicone rubber shall have a Shore 'A' hardness of not less than 60.

4.4.8.8 The composite suspension and tension insulators shall be of alternating shed design with aerodynamic type profile and without any under-ribs designed in accordance with IEC 60815-3. Weathersheds shall be at intervals to provide optimum electrical performance and the weathershed design shall provide a protected bottom surface that tends to keep dry in wet conditions.

4.4.8.9 The manufacturer shall determine if additional leakage distance is required based on the long term performance of the housing material and the proposed insulator environmental conditions.

4.4.8.10 The manufacturer shall provide the owner documentation which demonstrates satisfactory test results of specific formulations subjected to applicable environmental contamination together with satisfactory performance data of insulators (manufactured of the specified formulation) which have been installed on existing utility lines energized at the same voltage and in the same type of proposed environment.

4.4.8.11 The core/housing interface shall be manufactured so as to prevent leakage current flow over the surface of the core. The color and consistency of the material shall be uniform.

4.4.9 Metal Parts

4.4.9.1 The composite suspension insulator end fittings shall be designed to transmit the mechanical load to the FRP core and to develop the uniform and the consistent mechanical strength of the insulators.

4.4.9.2 Metal parts shall be made of the best commercial grade of malleable iron, ductile iron or steel, and shall be hot-dip galvanized in accordance with ASTM A153. Metal parts shall be weatherproof and corrosion and /or abrasion resistant.

4.4.9.3 The contours of the metal parts for composite insulators shall be uniform and without sharp edges or corners and shall be free of cracks, flakes, slivers, slag, blow-holes, shrinkage defects, and localized porosity and shall be designed such as to eliminate areas of high electrical stress concentrations.

4.4.9.4 The composite insulator's end fittings shall be attached to the FRP core through compression crimping process so that the end fittings uniformly transmit the mechanical load to the FRP core while providing a strength equal to or greater than the defined and specified ultimate strength of the insulator. The crimping process shall be performed with a symmetrically controlled crimping method that compresses the metal radially onto the rod and controlled by a specific method such as Acoustic Emission Detector to ensure that there is no damage to the core during the compression crimping operation.

4.4.9.5 Each insulator shall be permanently sealed at the interface between the metal end fittings and the housing to ensure that no moisture or foreign materials shall enter.

4.4.9.6 The metal end fittings and the housing of composite insulators after complete assembly shall be coaxial with one another and with the core, resulting in no eccentric loading.

4.4.9.7 The composite insulator end fittings at the line end shall be terminated with an IEC Class ball or clevis and at the grounded end with an IEC class socket or tongue couplings.

4.4.9.8 Cotter keys shall be grade 304L stainless steel (minimum grade).

4.4.9.9 Bolts, nuts, and spring lockwashers shall be made of steel and hot-dipped galvanized in accordance with ASTM A153, unless otherwise specified. Bolts may have either rolled or cut threads and shall have thread engagements capable of developing the specified strength of the unit. Nuts may be re-threaded after galvanizing to ensure clean threads, but bolts shall not be threaded or re-threaded after galvanizing. Threaded holes and nut threads shall be tapped oversize to closely fit those of the galvanized bolt with no unnecessary looseness, but free enough to permit the nut to be turned on freely with the fingers over the entire thread length.

4.4.10 Grading Devices

4.4.10.1 For composite insulator applications at 132kV and above, a grading ring shall be provided at the line end of the insulator. This shall control electrical stresses and ensure noise free insulator applications. The diameter of the ring and the tube shall be large enough to avoid local corona inception. For application at 500kV, a grading ring shall be provided at each end of the insulator.

4.4.10.2 The manufacturer shall provide purchaser with documentation that the insulator design with applicable grading devices will minimize or eliminate corona discharge activity under wet and dry conditions for the type of tower/pole-top configuration proposed. The effects of corona discharge activity on insulator life shall be negligible.

4.4.10.3 Due consideration shall be given to electric field concentrations at the live end to avoid excessive local electric stress. The design shall be demonstrated by 3-D electric field modeling of complete insulator unit along with associated corona and power arcing devices and tower/pole top proximity effects, results of which shall be provided to purchaser. Manufacturer should provide reports of successful electric field modelling testing for the specific insulator design. The EMF should be three dimensional with results containing drawing depicting the electric field in various colors, each of a different voltage level. The result of this study should show that the voltage field surrounding the composite insulator is optimum along the entire length of insulator, with the effected hot end of the insulator being a critical location. The threshold at which corona may or may not be present should be defined as a figure in kV/mm for the designated insulator.

4.4.10.4 To prevent or reduce the discharge activity due to corona/dry-band arcing, the surface electric field magnitudes on the weathershed material and surrounding end fitting seal shall not exceed 4.5kV/cm (rms) measured 0.5mm above the surface of sheath under dry and uncontaminated conditions.

4.4.10.5 All grading rings and brackets shall be designed as an integral part of the insulator assembly with a positive mounting system that allows mounting in only one position. The design of the grading ring shall be such that the ring can only be mounted with its orientation towards the weathersheds for maximum RIV and corona control.

4.4.10.6 Grading rings shall be designed in such a manner that the rings can be readily installed and removed with hot line tools without disassembling any other part of the insulator assembly.

4.4.11 Workmanship

4.4.11.1 Materials specified in the design and fabrication requirements of this specification shall be unused, recently manufactured, and free of defects or irregularities. The manufacturer is required to provide certificates of source material to the purchaser in this regard.

4.4.11.2 All components of the same design and designation shall be identical, and like components shall be interchangeable.

4.4.11.3 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

4.4.12 Markings

4.4.12.1 All the individual insulators and crates shall be provided with legible and durable markings as detailed below:

4.4.12.2 Insulator Markings

Each composite insulator shall bear a permanent marking in accordance with ANSI or IEC Standard on the end fitting. All the characters shall be legible, durable and permanently marked on one end fitting or on the uppermost shed of the insulator as follows. The use of labels shall not be permitted:

a. Manufacturer's Name or trademark
b. Year of Manufacture and serial number with Lot Number (if the order is large enough to contain lots).
c. Nominal System Voltage
d. Creepage/Leakage Distance or Section Length
e. Specified Mechanical Load (S.M.L.) in kN
f. Routine Test Load (R.T.L.) in kN
g. Country of Origin

4.4.12.3 Crate Markings

Each crate shall be marked with the following identifications:

a. Insulator Type and number of insulators
b. Manufacturer’s Name
c. Purchase Order Number/Contract Number
d. TLMS-8A:2016
e. Manufacturer’s Catalog No
f. Production Lot Number

5.0 QUALITY ASSURANCE MECHANISM

5.1 The manufacturer should be ISO 9001 certified and shall furnish a description of its Quality Assurance Program including fabrication, testing, and inspection. Any material (i.e., EPR), components (i.e., rod) or hardware (i.e., end fittings) the manufacturer has had fabricated by others should also be included.

5.2 The manufacturer shall furnish necessary documentation with regards to the manufacturing method and material compositions for record and future reference of purchaser.

5.3 The manufacturer shall maintain a development and engineering department to provide a technical after sales service and information related to the insulators.

6.0 INSPECTION AND TESTING

All test results shall be provided for review and acceptance by purchaser. The electrical tests shall be performed on composite insulators with grading ring(s), if applicable. *The type testing, in case of award, will be arranged at one of the STL accredited laboratories.*

6.1 Type Tests

6.1.1 All type tests prescribed herein below shall be performed on the representative composite insulator unit or on the first unit of every new design or rating to be supplied to purchaser.

6.1.2 The following type tests are to be carried out in accordance with the requirement and methods laid down in the standards/clauses mentioned therewith.

On Complete Composite Insulator along with Hardware Fittings

1.	Wet power frequency test	IEC 61109
2.	Dry lightning impulse withstand voltage test	IEC 61109
3.	Wet switching impulse withstand voltage test (for 500kV)	IEC-61109
4.	Pollution test	As per Clause 6.1.4
5.	Power arc test	IEC 61467
6.	Corona and RIV test	As per Clause 6.1.5
7.	Electric field modelling test (Applicable to 220kV and 500kV voltage)	As per requirements laid down in Clause 4.4.10

Note:
The insulator manufacturer shall have to coordinate testing of insulators with hardware fittings to be supplied by other manufacturer and shall have to also guarantee overall satisfactory performance of the insulators with the hardware fittings.

On Composite Insulator Units

1.	Tests on interfaces and connections of end fittings a) Sudden load release pre-stressing b) Thermal-mechanical pre-stressing	IEC-61109

	c) Water immersion pre-stressing d) Verification tests e) Visual examination f) Steep-front impulse voltage test g) Dry power-frequency voltage test	
2.	Tests on shed and housing material a) Hardness test b) Accelerated weathering test c) Tracking and erosion test d) Flammability test	IEC-61109
3.	Tests on core material a) Dye penetration test b) Water diffusion test	IEC-61109
4.	Assembled core-load time test a) Determination of the average failing load of the core of the assembled insulator b) Control of the slope of the strength-time curve of the insulator	IEC-61109
5.	Damage limit proof test and test of the tightness of the interface between end fittings and insulator housing	IEC-61109
6.	5000 hours ageing test	As per Clause 6.1.3
7.	Artificial pollution test	As per Clause 6.1.4
8.	High pressure water withstand test	As per Clause 6.1.6
9.	Brittle fracture resistance test	As per Clause 6.1.7
10.	Torsional load test	As per Clause 6.1.8
11.	Grading device test	As per Clause 6.1.9
12.	Recovery of hydrophobicity test	As per Clause 6.1.10

6.1.3 5000 hours Ageing Test

The test on housing shall include a minimum 5000 hours ageing test under operating voltage in accordance with Annexure C of IEC 61109-1992.

6.1.4 Artificial Pollution Test

The pollution test shall be performed in accordance with IEC 60507.
The type, procedure and contamination levels of Artificial Pollution Test shall be specified in the Purchase Order or Contract Schedules. Purchaser will require the bidder/manufacturer to perform one of the following Artificial Pollution Test (Salt Fog or Solid Layer Method):

a. Specified Withstand Voltage
b. 50 % Withstand Voltage

When, the Solid Layer Method is opted, the test shall be performed in accordance Procedure B – Wetting after energization.

To account for decrease in flashover voltage with increased NSDD (Non-Soluble Salt Deposit Density), NTDC will specify the project site NSDD (instead of the IEC recommend level of 0.1mg/cm^2) based on previously conducted contamination surveys.

6.1.5 RIV/Corona Test

To verify the requirements of Clause 4.3.3, radio influence voltage and visible corona tests shall be performed in accordance with ANSI C29.12.

6.1.6 The High Pressure Water Withstand Test

a. A power water wash test shall be performed on the composite horizontal line-post or composite suspension insulator in accordance with IEEE Std. 957 to demonstrate that the insulators can be power washed. The test shall be a water spray at a shed seam approximately 3 meters from the insulators. The spray shall be a solid stream through a 6mm diameter nozzle at 3800 kPa for a period of 10 (ten) minutes. There shall be no signs of water penetration through the housing or under the outside weathersheds into the core or at the silicone rubber sheath-hardware interface into the core.

b. The soundness of the insulators after washing shall be demonstrated by performing electrical tests (lightning impulse withstand/flashover and power frequency dry/wet withstand/flashover tests) followed by a mechanical test in accordance with the relevant IEC standard.

6.1.7 Brittle Fracture Resistance Test

The resistance of FRP core against brittle fracture shall be proven by a test on resistance of the FRP core against stress corrosion. The test shall be performed at an ambient temperature to confirm the mechanical resistance of the FRP core against stress corrosion. The test shall be performed as below:

a. One insulator sample from the first production lot or one specimen shall be used. The specimen shall have a length between end fittings of at least 10 times the core diameter. The end fittings shall be identical to those used in the production. The housing of the insulator shall be removed in the middle part of the insulator on a length of at least 150mm. The visible FRP core surface shall be smoothened by means of a fine abrasive cloth and the remaining parts of the housing shall be removed thoroughly.

b. An acid container made of polyethylene shall be arranged, surrounding the visible core surface in such a way that the liquid can simply be poured into the container and no acid comes into contact with the fittings. The size of the acid chamber shall be adapted in such a way that the FRP core is surrounded by a liquid thickness of not less than 10mm and a liquid level of not less than 40mm. The container shall be covered to limit evaporation of the liquid to maximum 5% of its volume during the test period.

c. The insulator shall be subjected to a tensile load applied between the metal fittings. The tensile load shall be increased rapidly but smoothly, from 0 to 67% of the specified mechanical load (S.M.L.) and then be maintained at this value for 96 hours. Immediately after applying a load, a nitric acid of a concentration 1 normal (63 gram of HNO3 added to 937 gram of water) shall be poured into the acid container. The acid must not come into contact with the end fittings.

d. The insulator shall be considered to pass the test if no fracture of the FRP core occurs during the 96 hours period.

6.1.8 Torsional Load Test

A torsional load of 55Nm shall be applied to the test specimens through a torque member so constructed that the specimens are not subjected to any cantilever stress. Insulators after torsion must pass the Dye Penetration Test as specified in IEC 61109.

6.1.9 Grading Device Test

Grading devices shall be tested using a mechanical shaker with at least a one inch (2.54cm) stroke at the grading device and a frequency of no less than three cycles per second for a duration of 2,000,000 cycles. Movement shall be along the long axis of the insulator. The test shall reflect the manufacturer's recommended method for attaching the grading device to the insulator. The grading device shall be attached to the insulator and the insulator attached to the shaker in a vertical position. The test shall be considered successful if no movement is detected in the ring with respect to the insulator and there is no physical damage to the grading device and the attachment assembly.

6.1.10 Recovery of Hydrophobicity Test

a. The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.
b. Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester. Holding the electrode approximately 3 mm from the sample surface slowly move the electrode over an area approximately 1'' x 1''. Continue treating this area for 2-3 minutes, operating the tester at maximum output.
c. Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic with an HC value of 6 to 7. If not,

dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.

d. Allow the sample to recover and repeat the hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

6.2 Routine Tests

The following routine tests prescribed herein below in accordance with the requirement and methods laid down in the standards mentioned therewith shall be performed by the manufacturer on all units prior to sample testing/FATs, to eliminate insulators with manufacturing defects. The manufacturer shall provide the purchaser with certified test reports for routine tests.

1.	Mechanical Routine Test	IEC-61109
2.	Visual Examination	IEC-61109

6.3 Sample Tests/FATs

All sample tests prescribed herein below in accordance with the requirement and methods laid down in the standards mentioned therewith shall be performed on each lot of insulator at random prior to delivery to purchaser.

1.	Verification of dimensions	IEC-61109
2.	Verification of locking system	IEC-61109
3.	Verification of tightness of the interface between end fittings and insulator housing	IEC-61109
4.	Verification of specified mechanical load (SML)	IEC-61109
5.	Galvanizing test	IEC-61109

<u>Sampling, Acceptance and Rejection</u>

The sampling shall be done as follows:

a) Verification of dimensions ..... (E1 + E2)
b) Verification of the locking system ..... .(E2)
c) Verification of the tightness of the interface between
end fittings and insulator housing ..... (E2)
d) Verification of the specified mechanical load, SML .....(E1)
e) Galvanizing test .....(E2)

Lot Size N	Sample Size	
	E1	E2
N≤300	Subject to agreement b/w purchaser and supplier	
300<N≤2000	4	3
2000<N≤5000	8	4
5000<N≤10000	12	6

In the event of a failure of the sample to satisfy a test, the re-testing procedure shall be applied as prescribed below.

Insulators of sample E2 only can be used in service and only if the galvanizing test is performed with the magnetic method.

Re-testing procedure

If only one insulator or end fitting fails to comply with the sampling tests, re-testing shall be performed using a new sample size equal to twice the quantity originally submitted to the tests.

The re-testing shall comprise the test in which failure occurred.

If two or more insulators or metal parts fail to comply with any of the sampling tests, or if any failure occurs during the re-testing, the complete lot is considered as not complying with this specification and shall be withdrawn by the manufacturer.

Provided the cause of the failure can be clearly identified, the manufacturer may sort the lot to eliminate all the insulators with this defect. The sorted lot may then be re-submitted for testing. The number then selected shall be three times the first quantity chosen for tests. If any insulator fails during this re-testing, the complete lot is considered as not complying with this specification and shall be withdrawn by the manufacturer.

6.4 Test Reports

Test reports shall include information that allows purchaser to clearly identify the units tested. The following information shall be included on the test reports:

- Purchase Order Number
- Shipment Date
- Destination
- Catalog Numbers
- Specified Mechanical Load of the Insulator's Core
- IEC Class End Fittings
- Number of Lots in the Shipment
- Number of Insulators in Each Lot
- Lot Code Numbers
- Date of Testing

• Name of Individual(s) Documenting the Tests

7.0 PACKAGING AND SHIPPING

The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.

7.1 Insulator Packaging

7.1.1 All insulators shall be packed in suitable PVC/plastic tubes/any other suitable packing along with temporary wrap-on shields/shrouds for each insulator unit. The packing shall provide protection against rodent etc. The shields/shrouds shall be for protection during transport and for preventing bird pecking during erection. Further, the shields/shrouds shall be made of opaque, weather proof material of adequate strength and shall be color coded. The shields/shrouds shall have smaller diameter than the insulator to stay in place against winds & weather and shall be designed so as to leave only the end fittings exposed for attachment of insulator to tower and line hardware until line construction is complete. The shield/shroud shall have suitable pull off loop for easy detachment just prior to charging of the line without causing any damage to the insulator. The manufacturer shall furnish detailed design of the packing and shield/shroud along with attachment and detachment procedure in this regard. For marine transportation, crates shall be palleted.

7.1.2 For marine transportation, Insulators shall be packaged in wooden crates completely enclosed on all sides with plywood and internal wooden supports constructed so each layer of insulators is self-supported by their own end fittings and not supported by a lower layer of insulators.

7.1.3 Wooden crate shall be treated to resist degradation using treating materials that have been determined not to harm the environment or the enclosed insulator in any manner.

7.1.4 Packaging in crates shall be such that Weathersheds shall not rest against adjacent insulator weathersheds such that bending of the weathershed occurs.

7.1.5 The number of insulator units per crate shall be reasonable and the crates shall be designed for forklift handling. The crates shall be strong enough to support stacking of the crates to a maximum level of three crates high.

7.1.6 All crates shall be marked legibly and correctly as per Clause 4.4.12.3.

7.1.7 The manufacturer shall guarantee the adequacy of the packing and shall be responsible for any loss or damage during transportation, handling, storage and installation due to improper packing.

7.2 Grading Device Packaging

7.2.1 The appropriate number of grading devices shall be packaged in a separate enclosed container and shipped in the same wooden container as the insulators they attach to. If the

grading devices are large, or the grading device container may damage the insulators during shipment, the grading devices may be shipped separately. If shipped separately, the grading device container and its associated insulator container must be clearly marked with easy to read matching identification.

7.2.2 Prior to the insulator delivery, the manufacturer shall supply purchaser with documentation explaining the use of matching identification number grading ring installation, insulator lot numbers and insulator identification numbers.

8.0 DRAWINGS

Drawings for each type of offered insulator shall be submitted with the bid. The drawings shall have a minimum of two views with an appropriate scale. Each drawing shall clearly show the following dimensions (including manufacturing tolerances) and ratings:

- Connection Length
- Number of Sheds
- Shed Interspaces
- Shed Diameter and inclination angle
- Core Diameter
- Dry Arc Distance
- Leakage Distance
- Approximate Weight
- Low-Frequency Dry Flashover
- Low-Frequency Wet Flashover
- Critical Impulse Flashover Positive
- Critical Impulse Flashover Negative
- Switching Impulse Flashover/Withstand
- Specified Mechanical Load
- Routine Test Load
- Rod Material and Manufacture
- Housing Material and Manufacture
- End Fitting Material and Manufacture
- Cross-Sectional View of Insulator Unit with Dimensions
- Size and Dimension Details for Both End Fittings
- Insulator Description
- Manufacturer's Catalog Number
- Manufacturer's Drawing Number
- Grading Ring Dimensions and Orientation
- Thickness of Zinc Coating
- Marking
- Insulator Color

All drawings shall be approved by purchaser before fabrication begins.

9.0 DOCUMENTATION

The manufacturer shall submit a complete bid proposal to the purchaser including the following documentation:

- Insulator Unit Cost Information
- Applicable Drawings with Associated Information as Specified in the Bidding Documents
- Ultimate Strength of Insulator (SML Rating)
- Maximum Continuous Working Load Ratings of Insulators (RTL Rating)
- Warranty Information
- Certified Test Reports (as required in Specification and Bidding Documents)
- Applicable Deflection and Combined Loading Application Curves
- Documentation of Insulator Performance in Proposed Installation Environment
- Insulator Washing Requirements and Procedures, If any
- Grading Device Information
- Delivery Date and Location
- Packaging and Shipping Details
- Special Application and/or Design Details
- Handling, Installation and Maintenance Details

DATA SCHEDULE
Composite Insulators

NTDC Tender/Purchase Order/Contract No.	Date:

Reference Clause of Specification	Description	A	B	C
3.0	APPLICABLE CODES AND STANDARDS			
	Applicable Industry Standards	*		
4.0	DESIGN REQUIREMENTS			
4.1	Insulator Type	Suspension Type		
4.2	Max. Diameter of Composite Suspension Insulator Weathershed (mm)	200		
	Type of End Coupling			
4.3	Ratings			
4.3.1	Nominal Length of Insulator (mm)	*		
	Min. Leakage Distance (mm)	*		
	Specified Mechanical Load 'SML' (kN)			
	Routine Test Load 'RTL' (kN)	*		
	Dry Arcing Distance (mm)			
	Type of Suspension String (Single/Double I-String, Vee String)			
	Type of Tension String (Single/Double/Triple/Quad)			
4.3.2	Electrical Values			
	Nominal System Voltage (kV) 132kV/220kV/500kV			
	Power Frequency Dry Withstand (kV)	*		
	Power Frequency Wet Withstand (kV)	*		
	Dry Lightning Impulse Withstand, Positive (kV)	*		
	Dry Lightning Impulse Withstand, Negative (kV)	*		
	Wet Switching Impulse Withstand (kV)			
4.3.3	Max. RIV at 1000kHz with Line to Ground (l-g) Voltage as per Clause 4.3.3	100µV		
4.3.4	Visible Corona Voltage Level, kV	*		
4.3.5	Receding water angle	80° or more		
	Weight per Unit (Kg)			
4.4	Type of weathershed			
	Coupling class/type of insulator end fitting	*		
	Insulator weathershed material	Silicone Rubber		

DATA SCHEDULE

Composite Insulators

Reference Clause of Specification	Description	A	B	C
	Weathershed profile (Regular/Alternating)	Alternate Weathershed		
	Min. sheath thickness over the core (mm)	>3		
	Min. silicone content of sheath-weathershed	≥30% By weight		
	Insulator core material	*		
	Core diameter (mm)	* (Φ24mm for 500kV)		
	Glass content in core (% by Volume)	>60		
	Insulator Fabrication Process (Molded/Modular/LSR)	*		
	Water washing pressure withstand	3800kPa		
	Attachment of Insulator End Fittings	Compression /Injection mold		
	Material of Insulator End Fittings	*		
	Material of Grading Device	*		

'A'– Purchaser Specified Data/Parameters
'B'– Bidder/Supplier/Manufacturer/Contractor Proposed Data/parameters
'C'– Remarks supporting the proposed deviation in Column B
(*)– Data/Parameters to be provided/proposed by the Bidder/Supplier/Manufacturer/Contractor in Column

DATA SCHEDULE

Composite Insulators

I: ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY PURCHASER

II: ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/SUPPLIER/ MANUFACTURER/CONTRACTOR

III: OTHER PARTICULARS TO BE FILLED UP BY BIDDER/SUPPLIER/MANUFACTURER/ CONTRACTOR

	Actual Manufacturer of Equipment/Material	Bidder/Supplier/Contractor
Name of the Company Location and Address		
Name and signature of Authorized Representative and Date		
Official Seal/Stamp of the Company and Date		

ANNEXURE-I

A. ELECTRICAL SYSTEM PARTICULARS

500KV LINES

i.	System Voltage	500kV
ii.	Maximum Voltage	550kV
iii.	BIL (Max)	1550kVp
iv.	BSL (Max)	1175kVp
v.	Power Frequency Withstand Voltage (wet)	680kVrms
vi.	Min. Corona Extinction Voltage at 50Hz under Dry Condition	346kV$_{l-g}$
vii.	Short Circuit Level in 1 second	63kA

220KV LINES

i.	System Voltage	220 kV
ii.	Maximum Voltage	245 kV
iii.	BIL (Max)	1050 kVp
iv.	Power Frequency Withstand Voltage (wet)	460 kVrms
v.	Min. Corona Extinction Voltage at 50Hz under Dry Condition	160kV$_{l-g}$
vi.	Short Circuit Level in 1 second	40 kA

132KV LINES

i.	System Voltage	132 kV
ii.	Maximum Voltage	145 kV
iii.	BIL (Max)	650 kVp
iv.	Power Frequency Withstand Voltage (wet)	275 kVrms
v.	Min. Corona Extinction Voltage at 50Hz under Dry Condition	100kV$_{l-g}$
vi.	Short Circuit Level in 1 second	31.5 kA

B. SERVICE CONDITIONS

Unless otherwise specified, the equipment/material shall be suitable to operate under the typical system parameters as stated below:

i.	Altitude above Mean Sea Level (MSL)	
ii.	Ambient Temperature:	
	a. Minimum	
	b. Maximum	

	c. Monthly average of the hottest month	
	d. Yearly average	
iii.	Ambient ground temperature	
iv.	Max. relative humidity	
v.	Contamination level:	
	a. Equivalent Salt Deposit Density (ESDD)	
	b. Non-Soluble Salt Deposit Density (NSDD)	
vi.	Average rainfall per year	
vii.	Design wind velocity	
viii.	Approximate highest density solar radiation averaged over the summer months	
ix.	a. Isokeraunic level (Average)	
	b. Isokeraunic level (Maximum)	
x.	Maximum Earthquake frequency/severity	
xi.	Climate conditions	