Bangladesh Power Development Board

Tender Document
For Supply & Installation of Plant & Equipment

(International)
One Stage Two Envelope Tendering for Turnkey Contract

"Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 05 Nos. 33/11kV New GIS Substation, 02 Nos. 33/11kV Substation (GIS Up-gradation), 33kV Bay-Extension at 02 Nos. Substation and 33kV Underground Cable Double Circuit Source Line with Civil and other related works including automation of the Sub-station (SAS) on Turnkey Basis under Power Distribution System Development, Chattogram Zone (2nd Phase), BPDB, Chattogram." (LOT-3)

Invitation for Tender No: .....

Issued on: .....

Tender Package No: GD-1

Tender Lot No: Lot-3

Volume- 1 of 2

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REJECTION CLAUSES

(Tender must comply with the following criteria along with all other rejection clauses mention in the tender document, otherwise tender shall be rejected)

1. Tenderer shall have to comply with Eligibility criteria (ITT 5), Litigation history (ITT 13), Experience criteria (ITT 14), Financial Criteria (ITT15), JVCA Criteria (ITT 18.2);
2. Tenderer shall have to submit sealed & signed tender document [ITT 24.2(r)(1)];
3. Tenderer shall have to comply Terms of Payment Clause [GCC 57], Time for Completion Clause [GCC 24.1] and Defect Liability Clause [GCC 42];
4. Tender shall remain valid for the period specified in TDS after the date of Tender submission deadline (ITT 30.2);
5. Tender must be accompanied by a valid Tender Security (ITT 34.3);
6. With Tender Submission Letter, Tender shall have to attached Letter of Authorization confirming the Signatory(ies) of the Tender to commit the Tenderer (ITT 37.4);
7. Tenderer shall have to submit Audited Financial reports and Letter of commitment for Line of Credit as evidence of Financial Capacity [ITT 15.1 (a)(b)];
8. If Tenderer participate in forming JVCA, then Tenderer shall have to submit Copy of the JVCA Agreement/Letter of Intent to form JVCA with draft proposed Agreement as per (ITT 18.1);
9. Tenderer shall have to submit Manufacturer's Authorization Letter [ITT 29.3 (b), ITT 24.2(r)(12, 15, 18 & 20);
10. Tenderer shall have to submit Manufacturer's Supply Experience, Satisfactory Performance Certificate(s) as per ITT 24.2(r) (13, 14) and Type Test Certificate/Report as per ITT 24.2(r);
11. Tenderer shall have to submit Guaranteed Technical Particulars (GTP) in respective Manufacturer's Letter Head /Official pad with sealed & signed by both respective Manufacturer's and Tenderer as per Section-08.

Section 1. Instructions to Tenderers

A. General

1. Scope of Tender

1.1 The Purchaser named in the Tender Data Sheet **(TDS) (**hereinafter referred to as the "Purchaser") wishes to issue these Tender Documents for the supply and installation of plant & equipment incidental thereto, as specified in the **TDS** and as detailed in Section 6: Employer's Requirements.

1.2 The name of the Tender and the number and identification of its constituent lot(s) are stated in the **TDS.**

1.3 Unless otherwise stated, throughout this Tender Document definitions and interpretations shall be as prescribed in the Section 3: General Conditions of Contract.

2. Interpretation

2.1 Throughout this Tender Document

(a) the term "in writing" means communication written by hand or machine duly signed and includes properly authenticated messages by facsimile or electronic mail;

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

(c) "day" means calendar days unless otherwise specified as working days;

(d) "Tender Document ", means the Document provided by a Purchaser to a Tenderer as a basis for preparation of its Tender;

(e) "Tender ", depending on the context, means a Tender submitted by a Tenderer for delivery of Goods and Related Services to a Purchaser in response to an Invitation for Tender ;

3. Source of Funds

3.1 The Purchaser has been allocated public funds from the source as indicated in the **TDS** and intends to apply a portion of the funds to eligible payments under the contract for which this Tender Document is issued.

3.2 For the purpose of this provision, "**public funds**" means any funds allocated to a Purchaser under Government budget, or loan, grants and credits placed at the disposal of a Purchaser through the Government by the development partners or foreign states or organizations.

3.3 Payments by the development partner, if so indicated in the **TDS**, will be made only at the request of the Government and upon approval by the development partner in accordance with the applicable Loan/Credit/Grant Agreement, and will be subject in all respects to the terms and conditions of that Agreement.

4. Corrupt, Fraudulent, Collusive, Coercive (or Obstructive in case of Development Partner) Practices

4.1 The Government and the Development Partner, if applicablerequires that the Procuring Entity as well as the Tenderers and Contracts (including , sub-contractors, agents, personnel, consultants, and service providers)shall observe the highest standard of ethics during implementation of procurement proceedings and the execution of Contracts under public funds.

4.2 For the purposes of ITT Sub Clause 4.3, the terms set forth below as follows:

(a) "corrupt practice" means offering, giving or promising to give, receiving, or soliciting either directly or indirectly, to any officer or employee of the Procuring Entity or other public or private authority or individual, a gratuity in any form; employment or any other thing or service of value as an inducement with respect to an act or decision or method followed by the Procuring Entity in connection with a Procurement proceeding or Contract execution;

(b) "fraudulent practice" means the misrepresentation or omission of facts in order to influence a decision to be taken in a Procurement proceeding or Contract execution;

(c) "collusive practice" means a scheme or arrangement between two (2) or more Persons, with or without the knowledge of the Procuring Entity, that is designed to arbitrarily reduce the number of Tenders submitted or fix Tender prices at artificial, non-competitive levels, thereby denying the Procuring Entity the benefits of competitive price arising from genuine and open competition;

(d) "coercive practice" means harming or threatening to harm, directly or indirectly, Persons or their property to influence a decision to be taken in the Procurement proceeding or the execution of a Contract, and this will include creating obstructions in the normal submission process used for Tenders.

(e) "Obstructive practice" (applicable in case of Development Partner) means deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede an 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.

4.3 Should any corrupt, fraudulent, collusive, coercive (or obstructive in case of Development Partner) practice of any kind is determined by the Procuring Entity or the Development Partner, if applicable, this will be dealt in accordance with the provisions of the Public Procurement Act and Rules and Guidelines of the Development Partners as stated in the ITT sub-clause 3.3.

In case of obstructive practice, this will be dealt in accordance with Development Partners Guidelines.

4.4 If corrupt, fraudulent, collusive, coercive (or obstructive in case of Development Partner) practices of any kind is determined by the Procuring Entity against any Tenderer or Contracts (including sub-contractors, agents, personnel, consultants, and service providers) in competing for, or in executing, a contract under public fund:

(a) Procuring Entity and/or the Development Partner shall exclude the concerned Tenderer from further participation in the concerned procurement proceedings;

(b) Procuring Entity and/or the Development Partner shall reject any recommendation for award that had been proposed for that concerned Tenderer;

(c) Procuring Entity and/or the Development Partner shall declare, at its discretion, the concerned Tenderer to be ineligible to participate in further Procurement proceedings, either indefinitely or for a specific period of time;

(d) Development Partner shall sanction the concerned Tenderer or individual, at any time, in accordance with prevailing Development Partner' sanctions procedures, including by publicly declaring such Tenderer or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Development Partner-financed contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or Contractor, or service provider of an otherwise eligible firm being awarded a Development Partner-financed contract; and

(e) Development Partner shall cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Procuring Entity or of a beneficiary of the loan engaged in corrupt, fraudulent, collusive, coercive or obstructive practices during the procurement or the execution of that Development Partner financed contract, without the Procuring Entity having taken timely and appropriate action satisfactory to the Development Partner to remedy the situation.

4.5 Tenderer shall be aware of the provisions on corruption, fraudulence, collusion, coercion (and obstruction, in case of Development Partner) of the Public Procurement Act, 2006, the Public Procurement Rules, 2008 and others as stated in GCC Clause 38.

4.6 In further pursuance of this policy, Tenderers, Contractors and their sub-contractors, agents, personnel, consultants, service providers shall permit the Government and the Development Partner to inspect any accounts and records and other documents relating to the Tender submission and contract performance, and to have them audited by auditors appointed by the Government and/or the Development Partner during the procurement or the execution of that Development Partner financed contract.

5. Eligible Tenderers

5.1 This Invitation for Tenders is open to all potential Tenderers from all countries, except for any specified in the **TDS.**

5.2 Tenderers shall have the legal capacity to enter into the Contract under the Applicable law.

5.3 Tenderers shall be enrolled in the relevant professional or trade organisations registered in Bangladesh.

5.4 Tenderers may be a physical or juridical individual or body of individuals, or company, association or any combination of them in the form of a Joint Venture(JV) invited to take part in public procurement or seeking to be so invited or submitting a Tender in response to an Invitation for Tenders.

5.5 Tenderers shall have fulfilled its obligations to pay taxes and social security contributions under the provisions of laws and regulations of the country of its origin.

5.6 Tenderers should not be associated, or have been associated in the past, directly or indirectly, with a consultant or any of its affiliates which have been engaged by the Procuring Entity to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the works to be performed under this Invitation for Tenders.

5.7 Tenderers in its own name or its other names or also in the case of its Persons in different names shall not be under a declaration of ineligibility for corrupt, fraudulent, collusive or coercive practices as stated under ITT Sub Clause 4.4 (or obstructive practice, in case of Development Partner) in relation to the Development Partner's Guidelines in projects financed by Development Partner.

5.8 Tenderers are not restrained or barred from participating in Public Procurement on grounds of poor performance in the past under any Contract.

5.9 Tenderers shall not be insolvent, be in receivership, be bankrupt, be in the process of bankruptcy, be not temporarily barred from undertaking business and it shall not be the subject of legal proceedings for any of the foregoing.

5.10 Government-owned enterprise in Bangladesh may also participate in the Tender if it is legally and financially autonomous, it operates under commercial law, and it is not a dependent agency of the Procuring Entity.

5.11 Tenderers shall provide such evidence of their continued eligibility satisfactory to the Procuring Entity, as the Procuring Entity will reasonably request.

5.12 These above requirements for eligibility will extend, as applicable, to each JV partner and Subcontractor proposed by the Tenderers.

5.13 Tenderers shall have the up-to-date valid license(s), issued by the corresponding competent authority, as specified in the **TDS.**

6. Eligible Plant and Services

6.1 The plant and services to be supplied under the contract are eligible, unless their origin is from a country specified in the **TDS** and all expenditures under the contract will be limited to such plant, and services.

6.2 For purposes of this Clause, the term “plant” means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided in the facilities; and “installation services” means all those services ancillary to the supply of the Plant for the Facilities, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation, installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training etc

6.3 For purposes of this clause, “origin” means the place where the plant, or component parts thereof are mined, grown, produced or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially different in its basic characteristics or in purpose or utility from its components or 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.

6.4 The origin of plant & equipment is distinct from the nationality of the Tenderer. The nationality of the firm that produces, assembles, distributes, or sells the goods shall not determine their origin.

7. Site Visit

7.1 The Tenderer is advised to visit and examine the site where the plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the tender and entering into a contract for the provision of Plant and Installation Services.

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

7.3 The Tenderer should ensure that the Purchaser is informed of the visit in adequate time to allow it to make appropriate arrangements.

7.4 The costs of visiting the Site shall be at the Tenderer’s own expense.

B.Tender Document

8. Tender Document: General

8.1 The Sections comprising the Tender Document are listed below, and should be read in conjunction with any Addendum issued under ITT Clause 11.

- Section 1 Instructions to Tenderers (ITT)
- Section 2 Tender Data Sheet (**TDS**)
- Section 3 General Conditions of Contract (GCC)
- Section 4 Particular Conditions of Contract (**PCC**)
- Section 5 Tender and Contract Forms
- Section 6 Employer's Requirements
- Section 7 Technical Specification
- Section 8 Guaranteed Technical Particular
- Section 9 Drawings

8.2 The Purchaser shall reject any Tender if the Tender Document was not purchased directly from the Purchaser, or through its agent as stated in the **TDS.**

8.3 The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document as well as addendum to Tender Documents.

9. Clarification of Tender Document

9.1 A prospective Tenderer requiring any clarification of the Tender Document shall contact the Purchaser in writing at the Purchasers address indicated in the **TDS** before **two-third** of time allowed for preparation and submission of Tender elapses.

9.2 The Procuring Entity is not obliged to answer any clarification request received after that date as stated under ITT Sub Clause 9.1.

9.3 The Procuring Entity shall respond in writing within five (5) working days of receipt of any such request for clarification received under ITT Sub Clause 9.1.

9.4 The Procuring Entity shall forward copies of its response to all those who have purchased the Tender Document, including a description of the enquiry but without identifying its source.

9.5 Should the Procuring Entity deem it necessary to revise the Tender Document as a result of a clarification, it will do so following the procedure under ITT Clause 11.

10. Pre-Tender Meeting

10.1 To clarify issues and to answer questions on any matter arising in the Tender Document, the Purchaser may, if stated in the **TDS**, hold a Pre-Tender Meeting at the place, date and time as specified in the TDS. All Potential Tenderers are encouraged to attend the meeting, if it is held.

10.2 Minutes of the pre-Tender meeting, including the text of the questions raised and the responses given, together with any responses prepared after the meeting, will be transmitted within one week (7 days) after holding the meeting to all those who purchased the Tender Document and even those who did not attend the meeting.

10.3 Any amendment to the Tender Documents listed in ITT Sub-Clause 8.1 that may become necessary as a result of the pre-Tender meeting shall be made by the Purchaser exclusively

through the issue of an Addendum as stated under ITT Sub-Clause 11 and not through the minutes of the pre-Tender meeting.

10.4 Non-attendance at the Pre-Tender meeting will not be a cause for disqualification of a Tenderer.

11. Addendum to Tender Document

11.1 At any time prior to the deadline for submission of Tenders, the Purchaser on its own initiative or in response to a clarification request in writing from a Tenderer, having purchased the Tender Document or as a result of a Pre-Tender meeting, may revise the Tender Document by issuing an addendum pursuant to Rule 95 of the Public Procurement Rules, 2008.

11.2 The addendum issued under ITT Sub-Clause 11.1 shall become an integral part of the Tender Document and shall have a date and an issue number and shall be circulated by fax, mail or e-mail, to Tenderers who have purchased the Tender Documents within five (5) working days of issuance of such addendum, to enable Tenderers to take appropriate action.

11.3 The Tenderer shall acknowledge receipt of an addendum.

11.4 Tenderers who have purchased the Tender Documents but have not received any addendum issued under ITT Sub-clause 11.1 shall inform the Purchaser of the fact by fax, mail or e-mail before **two-third** of the time allowed for the submission of Tenders has elapsed.

11.5 Procuring Entities shall also ensure posting of relevant addenda with the reference number and date on their website.

11.6 To give a prospective Tenderer reasonable time in which to take an amendment into account in preparing its Tender, the Purchaser may, at its discretion, extend the deadline for the submission of Tenders, pursuant to Rule 95(6) of the Public Procurement Rule, 2008 and under ITT Clause 36.

11.7 If an addendum is issued when time remaining is less than one-third of the time allowed for the preparation of Tenders, a Purchaser shall extend the deadline by an appropriate number of days for the submission of Tenders, depending upon the nature of the Procurement requirement and the addendum. The minimum time for such extension shall not be less than seven (7) days.

C. Qualification Criteria

12. General Criteria

12.1 The Tenderer shall possess the necessary professional and technical qualifications and competence, financial resources, equipment and other physical facilities, managerial capability, specific experience, reputation, and the personnel, to perform the contract.

12.2 In addition to meeting the eligibility criteria, as stated in ITT Clause 5, the Tenderer must satisfy the other criteria stated in ITT Clauses 13 to 15 inclusive.

12.3 To qualify for multiple number of contracts/lots in a package made up of this and other individual contracts/lots for which tenders are invited in the Invitation for Tenders, the Tenderer shall demonstrate having resources and experience sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

13. Litigation History

13.1 The maximum number of arbitration awards against the Tenderer over a period shall be as specified in the **TDS.**

14. Experience Criteria

14.1 Tenderers shall have the following minimum level of supply experience to qualify for supplying the Plant and Services under the contract:

(a) a minimum number of years of general experience in the role of Contractor or Subcontractor or Management Contractor as specified in the **TDS**; and

(b) Specific experience as a Contractor or Subcontractor or Management Contractor that are similar to the proposed plant and services in at least a number of contract(s) and of a minimum value over the period, as specified in the **TDS**.

15. Financial Criteria

15.1 Tenderers shall have the following minimum level of financial capacity of qualify for the supply, execution and performance of plant and services under the contract.

(a) the average annual turnover as specified in the **TDS** calculated as total certified payments received for contracts in progress or completed, during the period specified in the **TDS;**

(b) availability of minimum liquid assets or working capital or credit facilities, as specified in the **TDS**; and;

(c) satisfactory resolution of all claims, arbitrations or other litigation cases and shall not have serious negative impact on the financial capacity of the Tenderer.

16. Personnel Capacity

16.1 The Tenderer shall have the following minimum level of personnel capacity to qualify for the performance of the plant and services under the Contract.

A Project Manager, Engineers, and other key staff with qualifications and experience as specified in the **TDS;**

17. Equipment Capacity

17.1 The Tenderer shall own suitable equipment and other physical facilities or have proven access through contractual arrangement to hire or lease such equipment or facilities for the desired period, where necessary or have assured access through lease, hire, or other such method, of the essential equipment, in full working order, as specified in the **TDS.**

18. Joint Venture, Consortium or Association

18.1 The Tenderer may participate in the procurement proceedings forming a Joint Venture, Consortium or Associations (JVCA) by an agreement, executed case by case on a non judicial stamp of value as stated in **TDS** or alternately with the intent to enter into such an agreement supported by a Letter of Intent along with the proposed agreement duly signed by all partners of the intended JVCA and authenticated by a Notary Public.

18.2 The figures for each of the partners of a JVCA shall be added together to determine the Tenderer's compliance with the minimum qualifying criteria; however, for a JVCA to qualify, lead partner and its other partners must meet the criteria stated in the **TDS.** Failure to comply with these requirements will result in rejection of the JVCA Tender. Subcontractors' experience and resources will not be taken into account in determining the Tenderer's compliance with the qualifying criteria.

18.3 Each partner of the JVCA shall be jointly and severally liable for the execution of the Contract, all liabilities and ethical and legal obligations in accordance with the Contract terms.

18.4 The JVCA shall nominate a Representative (partner-in-charge/Lead Firm) who shall have the authority to conduct all business for and on behalf of any and all the partners of the JVCA during the tendering process and, in the event the JVCA is awarded the Contract, during contract execution including the receipt of payments for and on behalf of the JVCA.

18.5 Each partner of the JVCA shall complete the JVCA Partner Information (**Form PG5A-2b)**for submission with the Tender

19. Subcontractor(s)

19.1 Tenderer, pursuant to Rule 53 of the PPR2008, is allowed to sub-contract a portion of the Supply.

19.2 The Tenderer shall specify in its Tender all portion of the Plant and Services that will be subcontracted, if any, including the entity(ies) to whom each portion will be subcontracted to, subject to the maximum allowable limit for subcontracting of Plant and Services specified in the **TDS**.

19.3 The Purchaser may require Tenderers to provide more information about their subcontracting arrangements. If any Subcontractor is found ineligible or unsuitable to carry out the subcontracted tasks, the Procuring Entity may request the Tenderer to propose an acceptable substitute.

19.4 The Purchaser may also select nominated Subcontractor(s) to execute certain specific components of the Works and if so, those will be specified in the **TDS**.

19.5 The successful Tenderer shall under no circumstances assign the goods/works/services or any part of it to a Subcontractor

19.6 Subcontractors must comply with the provision of ITT Clause 5. For this purpose contractor shall complete the Subcontractor's information in Form **PG5A-2c** for submission with tender

19.7 If the Purchaser determines that a subcontractor is ineligible, the subcontracting of such portion of the Plants and Services assigned to the ineligible subcontractor shall be disallowed

D. Tender Preparation

20. Only one Tender

20.1 If a Tender for Plant and Services is invited on 'lot-by-lot' basis, each lot shall constitute a tender. A Tenderer shall submit only one (1) Tender for each lot, either individually or as a JVCA. The Tenderer who submits or participates in more than one (1) Tender for each lot will cause all the Tenders with that Tenderer's participation to be rejected.

21. Cost of Tendering

21.1 Tenderers shall bear all costs associated with the preparation and submission of its Tender, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Tendering process.

22. Issuance and Sale of Tender Document

22.1 A Purchaser, pursuant to Rule 94 of the Public Procurement Rules, 2008 shall make Tender Documents available immediately to the potential Tenderers, requesting and willing to purchase at the corresponding price if the advertisement has been published in the newspaper pursuant to Rule 90 of the Public Procurement Rules, 2008.

22.2 Full contact details with mailing address, telephone and facsimile numbers and electronic mail address, as applicable, of those to whom Tender Documents have been issued shall be recorded with a reference number by the Purchaser or its agent.

22.3 There shall not be any pre-conditions whatsoever, for sale of Tender Document and the sale of such Document shall be permitted up to the day prior to the day of deadline for the submission of Tender.

23. Language of Tender

23.1 Tenders shall be written in the English language. Correspondences and documents relating to the Tender may be written in English or *Bangla.* Supporting documents and printed literature furnished by the Tenderers that are part of the Tender may be in another language, provided they are accompanied by an accurate translation of the relevant passages in the English or *Bangla* language, in which case, for purposes of interpretation of the Tender, such translation shall govern.

23.2 Tenderers shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.

24. Contents of Tender (Document establishing the tender's qualification)

24.1 The Tender prepared by the Tenderers shall comprise Two Envelope submitted simultaneously, one called the **Technical Offer** (**Envelope-01**) containing the documents listed in ITT 24.2 and other called the **Financial Offer** containing the documents listed in 24.3, both envelopes enclosed together in an outer Single envelope.

24.2 The **Technical Offer** (**Envelope-01**) prepared by the Tenderers will comprise the following:

(a) Technical Submission Letter (**Form PG5A-1a**) as furnished in Section 5: Tender and Contract Forms. This form must be completed without any alterations to its format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested

(b) Tenderer Information Sheet (**Form PG5A-2**)as furnished in Section 5: Tender and Contract Forms;

(c) Tender Security as stated under ITT Clause 32,33 and 34;

(d) Technical Proposal (Form PG5A-4) as furnished in Section 5: Tender and Contract Forms.

(e) Alternatives, if permitted, as stated under with ITT Clause 25;

(f) Written confirmation authorising the signatory of the Tender to commit the Tenderer, as stated under ITT Sub-Clause 37.3;

(g) The completed eligibility declarations, to establish its eligibility as stated under ITT Clause 5, in the Tender Submission Sheet (Form PG5A-1a & 1b), as furnished in section 5: Tender and Contract Forms;

(h) An affidavit confirming the legal capacity stating that there are no existing orders of any judicial court that prevents either the Tenderer or employees of a Tenderer entering into or signing a Contract with the Purchaser as stated under ITT clause 5;

(i) An affidavit confirming that the Tenderer is not insolvent, in receivership or not bankrupt or not in the process of bankruptcy, not temporarily barred from undertaking their business for financial reasons and shall not be the subject of legal proceedings for any of the foregoing as stated under ITT Clause 5;

(j) A certificate issued by the competent authority stating that the Tenderer is a Tax payer having valid Tax Identification Number (TIN) and VAT registration number or in lieu any other document acceptable to the Purchaser demonstrating that the Tenderer is a genuine Tax payer and has a VAT registration number as a proof of fulfillment of taxation obligations as stated under ITT Clause 5. In the case of foreign Tenderers, a certificate of competent authority in that country of which the Tenderer is citizen shall be provided ;

(k) Documentary evidence demonstrating that they are enrolled in the relevant professional or trade organizations registered in Bangladesh or in case of foreign tenderer in their country of origin or a certificate concerning their competency issued by a professional institution in accordance with the law of the country of their origin, as stated under ITT Clause 5;

(l) The country of origin declarations, to establish the eligibility of the Plant and Services as stated under ITT Clause 6, in the Price Schedule for Plant and Services (**Form PG5A-3**) as, applicable, furnished in Section 5: Tender and Contract Forms;

(m) Documentary evidence as stated under ITT Clauses 28, that the Goods and Related Services conform to the Tender Documents;

(n) Documentary evidence as stated under ITT Clause 29 that the Tenderer's qualifications conform to the Tender Documents;

(o) Documents establishing legal and financial autonomy and compliance with commercial law, as stated under ITT Sub-clause 5.3 in case of government owned entity; and

(p) In addition to the requirements stated under ITT Sub Clause 18.1, Tenders submitted by a JVCA or proposing a

Subcontractor shall include.

i. a Joint Venture Agreement entered into by all partners, executed on a non-judicial stamp of value or equivalent as stated under ITT Sub Clause 18.1; or

ii. a Letter of Intent along with the proposed agreement duly signed by all partners of the intended JVCA with the declaration that it will execute the Joint Venture agreement in the event the Tenderer is successful;

iii. the JVCA Partner Information (**Form PG5A-2b**);

iv. the Subcontractor Information (**Form PG5A-2c**).

(q) the completed Specifications Submission and Compliance Sheet **(Form PG5A-4a)**as stated under ITT clause 28.1;

(r) Any other document as specified in the **TDS.**

24.3 The Financial Offer (**Financial Envelope -02**) prepared by the Tenderers shall comprise the following:

(a) The Financial offer Submission Letter (**Form PG5A-1b**) as furnished in Section 5:

(b) The Tenderer shall submit the completed Price Schedule for Plant and Services (**Form PG5A-3**), according to their origin as appropriate as furnished in section 5: Tender and Contract Forms.

(c) the written confirmation authorizing the signatory of the Tender to commit the Tenderer, as stated under ITT Sub Clause 37.3;

(d) any other document as specified in the **TDS**.

25. Alternatives

25.1 Unless otherwise stated in the **TDS**, alternatives shall not be considered.

26. Tender Prices, Discounts & Price adjustment

26.1 Unless otherwise **specified in the TDS,** tenderers shall quote for the entire Plant and Installation Services on a "single responsibility" basis such that the total tender price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the tender document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the tender document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Tender Document, all in accordance with the requirements of the General Conditions of Contract. Items against which no price is entered by the Tenderer will not be paid for by the Purchaser when executed and shall be deemed to be covered by the prices for other items.

26.2 Tenderers are required to quote the price for the commercial, contractual and technical obligations outlined in the tender document

26.3 Tenderers shall give a breakdown of the prices in the manner

and detail called for in the Price Schedules included in Section 5, Tender and Contract Forms.

26.4 Depending on the scope of the Contract, the Price Schedules may comprise up to the seven (7) schedules listed below. Separate numbered Schedules included in Section IV, Tender Forms, from those numbered 1-5 below, shall be used for each of the elements of the Plant and Installation Services. The total amount from each Schedule corresponding to an element of the Plant and Installation Services shall be summarized in the schedule titled Grand Summary, (Schedule 6), giving the total tender price(s) to be entered in the Letter of Tender.

Schedule No. 1 Plant (including Mandatory Spare Parts) Supplied from Abroad

Schedule No. 2 Plant (including Mandatory Spare Parts) Supplied from within the Purchaser's Country

Schedule No. 3 Design Services

Schedule No. 4 Civil works part

Schedule No. 5 Installation Services

Schedule No. 6 Grand Summary (Schedule Nos. 1 to 5)

Schedule No. 7 Recommended Spare Parts

Tenderers shall note that the plant and equipment included in Schedule Nos. 1 and 2 above **exclude** materials used for civil, building and other construction works. All such materials shall be included and priced under Schedule No. 5, Installation Services.

26.5 In the Schedules, tenderers shall give the required details and a breakdown of their prices as follows:

a) Plant to be supplied from abroad (Schedule No. 1):

The price of the plant shall be quoted on CIP-named place of destination/CIF basis as **specified in the TDS** and as applicable.

(b) Plant manufactured within the Purchaser's country (Schedule No. 2):

i) The price of the plant shall be quoted on an EXW INCOTERM basis (such as "ex-works," "ex-factory," "ex-warehouse" or "off-the-shelf," as applicable),

(ii) Sales tax and all other taxes payable in the Employer's country on the plant if the contract is awarded to the Tenderer, and

(iii) The total price for the item.

(c) Design Services (Schedule No. 3).

(d) Civil works part (Schedule No. 4)

(e) Installation Services shall be quoted separately (Schedule No. 5) and shall include rates or prices for local transportation to named place of final destination as **specified in the TDS,** insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Tender Document,

as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's country as of twenty-eight (28) days prior to the deadline for submission of tenders.

(f) Recommended spare parts shall be quoted separately (Schedule 7) as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts

26.6 The current edition of INCOTERMS, published by the International Chamber of Commerce shall govern.

26.7 The prices shall be either fixed or adjustable as specified in the **TDS**.

26.8 In the case of **Fixed Price**, prices quoted by the Tenderer shall be fixed during the Tenderer's performance of the contract and not subject to variation on any account. A tender submitted with an adjustable price quotation will be treated as non-responsive and rejected.

26.9 In the case of **Adjustable Price**, prices quoted by the Tenderer shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport and contractor's equipment in accordance with the procedures specified in the corresponding Appendix to the Contract Agreement. A tender submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. Tenderers are required to indicate the source of labor and material indices in the corresponding Form in Section 5, Tender and Contract Forms

26.10 If so indicated in ITT 1.2, tenders are to be invited for individual lots or for any combination of lots (packages). Tenderers wishing to offer any price reduction (discount) for the award of more than one lot shall specify in their Tender Submission Letter the price reductions applicable to each package, or alternatively, to individual Contracts within the package, and the manner in which the price reductions will apply.

26.11 Tenderers wishing to offer any unconditional discount shall specify in their Letter of Tender the offered discounts and the manner in which price discounts will apply.

26.12 If so indicated under ITT Sub Clause 26.9, Tenders are being invited with a provision for price adjustments. The unit rates or prices quoted by the Tenderer are subject to adjustment during the performance of the Contract in accordance with the provisions of the relevant GCC Clause and, in such case the Employer shall provide the indexes and weightings or coefficients in **Appendix to the Tender** for the price adjustment formulae specified in the **PCC.**

26.13 The Employer may require the Tenderer to justify its proposed indexes, if any of those as stated under ITT Sub Clause 26.12, are instructed to be quoted by the Tenderer in **Appendix to the Tender**.

26.14 The price adjustment stated under ITT Sub Clause 26.9and 26.12 shall be dealt with in accordance with the provisions in Section 12 and 22 of the Public Procurement Act, 2006 and Rule

5 and 38 of the Public Procurement Rules, 2008.

27. Tender Currency

27.1 For expenditures that will be incurred in Bangladesh, the Tenderer shall quote the prices in Bangladesh Taka

27.2 Suppliers offering Goods manufactured or assembled in Bangladesh are permitted to submit their Tender in a combination of local and foreign currencies.

27.3 In case of National Tender, all quoted price shall be in local currency.

27.4 In case of international competitive tender, for expenditures that will be incurred outside Bangladesh, the Tenderer may quote the prices as specified in **TDS**.

28. Documents Establishing the Conformity of Plant, and Services

28.1 To establish the conformity of the plant and services to the Tender Documents, the Tenderer shall furnish as part of its Tender the documentary evidence that the Goods and Related services conform to the technical specifications and standards in Section 6, Employer's Requirement.

a. a detailed description of the essential technical and performance characteristics of the plant and services, including the functional guarantees of the proposed plant and services, in response to the Specification

b. a list giving full particulars, including available sources, of all spare parts and special tools necessary for the proper and continuing functioning of the plant for the period named in the **TDS**, following completion of plant and services in accordance with provisions of contract; and

c. a commentary on the Employer's Specification and adequate evidence demonstrating the substantial responsiveness of the plant and services to those specifications. Tenderers shall note that standards for workmanship, materials and equipment designated by the Employer in the Tender Document are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Tenderer may substitute alternative standards, brand names and/or catalog numbers in its tender, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Specification.

29. Documents Establishing Eligibility of the Tenderer

29.1 Tenderers, if applying as a sole Tenderer, shall submit documentary evidence to establish its eligibility as stated under ITT Clause 5 and, in particular, it shall:

(a) complete the eligibility declarations in the Tender Submission Letter (**Form PG5A-1a**);

(b) complete the Tenderer Information (**Form PG5A-2a**);

(c) complete Subcontractor Information (**Form PG5A-2c**), if it intends to engage any Subcontractor(s).

29.2 Tenderers, if applying as a partner of an existing or intended JV shall submit documentary evidence to establish its eligibility as stated under ITT Clause 5 and, in particular, in addition to as stated under ITT Sub Clause 29.1, it shall:

(a) provide for each JV partner, completed JV Partner Information (**Form PG5A-2b**);

(b) provide the JV agreement or Letter of Intent along with the proposed agreement of the intended JV as stated under ITT Sub Clause 18.1

29.3 The documentary evidence of the Tenderer's qualifications to perform the contract if its Tender is accepted shall establish to the Purchaser's satisfaction:

(a) that the Tenderer meets each of the qualification criterion specified in Sub-Section C, Qualification Criteria of the ITT;

(b) that, if required in the TDS, a Tenderer that does not manufacture or produce the Goods it offers to supply shall submit the Manufacturer's Authorization Letter **(Form PG5A-5)** furnished in Section 5: Tender and Contract Forms, to demonstrate that it has been duly authorized by the manufacturer or producer of the Goods to supply the Goods to Bangladesh.; and

(c) that, if required in the TDS, in case of a Tenderer not doing business within Bangladesh, the Tenderer 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.

30. Validity Period of Tender

30.1 Tender validities shall be determined on the basis of the complexity of the Tender and the time needed for its examination, evaluation, approval of the Tender and issuance of the Notification of Award (NOA).

30.2 Tenders shall remain valid for the period specified in the **TDS** after the date of Tender submission deadline prescribed by the Purchaser, as stated under ITT Clause 39. A Tender valid for a period shorter than that specified will be rejected by the Purchaser as non- responsive.

31. Extension of Tender Validity and Tender Security

31.1 In justified exceptional circumstances, prior to the expiration of the Tender validity period, the Purchaser following Rule 21 of the Public Procurement Rules, 2008 may solicit, **not later than ten (10) days** before the expiry date of the Tender validity, compulsorily all the Tenderers' consent to an extension of the period of validity of their Tenders.

31.2 The request for extension of Tender validity period shall state the new date of the validity of the Tender.

31.3 The request from the Purchaser and the responses from the Tenderers will be made in writing.

31.4 Tenderers consenting in writing to the request made by the Purchaser under ITT Sub-Clause 30.1 shall also correspondingly extend the validity of its Tender Security for twenty-eight (28) days beyond the new date for the expiry of Tender validity.

31.5 Tenderers consenting in writing to the request under ITT Sub-

Clause 31.1 shall not be required or permitted to modify its Tender in any circumstances.

31.6 If the Tenderers are not consenting in writing to the request made by the Purchaser under ITT Sub-Clause 31.1, its Tender will not be considered for subsequent evaluation.

32. Tender Security

32.1 The Tender Security and its amount shall be determined sufficient to discourage the submission of frivolous and irresponsible tenders pursuant to Rule 22 of the Public Procurement Rule2008 and shall be expressed as a rounded fixed amount and, shall not be stated as a precise percentage of the estimated total Contract value.

32.2 The Tenderer shall furnish as part of its Technical offer (**envelope-1**) Tender, in favour of the Purchaser or as otherwise directed on account of the Tenderer, a ender security in original form (not copy) and in the amount as specified in **TDS.**

32.3 If the Tender is a Joint Venture, the Tenderer shall furnish as part of its Tender, in favour of the Procuring Entity or as otherwise directed on account of the title of the existing or intended JVCA or any of the partners of that JVCA or in the names of all future partners as named in the Letter of Intent of the JVCA, a Tender Security in original form and in the amount as stated under ITT Sub Clause 32.1.

33. Form of Tender security

33.1 The Tender Security shall:

(a) In case of NCT, at the Tenderer's option, be either;

(i) In the form of a Bank Draft, Pay order or

(ii) in the form of an irrevocable bank guarantee issued by any scheduled Bank of Bangladesh, in the format **(Form PG5A-6)** furnished in Section 5: Tender and Contract Forms.

(b) In case of ICT, in the form of an irrevocable bank guarantee issued by an internationally reputable bank and shall require to be endorsed by its any correspondent bank located in Bangladesh, to make it enforceable, in the format **(Form PG5A-6)** furnished in Section 5: Tender and Contract Forms;

33.2 Tender security shall be payable promptly upon written demand by the Purchaser in the case of the conditions listed in ITT Clause 36 being invoked; and

33.3 Tender security shall remain valid for at least twenty eight (28) days beyond the expiry date of the Tender Validity in order to make a claim in due course against a Tenderer in the circumstances detailed under ITT Clause 36.

34. Authenticity of Tender Security

34.1 The authenticity of the Tender security submitted by a Tenderer shall be examined and verified by the Purchaser in writing from the Bank issuing the security, prior to finalization of the Evaluation Report pursuant to Rule, 24 of the Public Procurement Rule, 2008.

34.2 If a Tender Security is found to be not authentic, the Tender which it covers shall not be considered for subsequent evaluation and in such case the Purchaser shall proceed to take punitive measures against that Tenderer as stated under ITT Sub-Clause

4.6, pursuant to Rule 127 of the Public Procurement Rules, 2008 and in accordance with Section 64(5) of the Public Procurement Act, 2006.

34.3 Tender not accompanied by a valid Tender Security as stated under Sub-Clause 29, 30 and 31, shall be considered as non-responsive.

35. Return of Tender Security

35.1 No Tender security shall be returned by the Tender Opening Committee (TOC) during and after the opening of the Tenders pursuant to Rule 26 of the Public Procurement Rules 2008.

35.2 No Tender security shall be returned to the Tenderers before contract signing, except to those who are found non-responsive.

35.3 Tender securities of the non-responsive Tenders shall be returned immediately after the Evaluation Report has been approved by the Purchaser.

35.4 Tender securities of the responsive Tenderers shall be returned only after the lowest evaluated responsive Tenderer has submitted the performance security and signed the contract, that being even before the expiration of the validity period specified in Clause 30.

35.5 Tender Securities of the Tenderers not consenting within the specified date in writing to the request made by the Purchaser under ITT Sub-Clause 31.1 in regard to extension of its Tender validity shall be discharged or returned forthwith.

36. Forfeiture of Tender Security.

36.1 The Tender security pursuant to Rule 25 of the Public Procurement Rules,2008 may be forfeited if a Tenderer:

(a) withdraws its Tender after opening of Tenders but within the validity of the Tender as stated under ITT Clauses 30,and 31, pursuant to Rule 19 of the Public Procurement Rules 2008; or

(b) refuses to accept a Notification of Award as stated under ITT Sub-Clause 65.3, pursuant to Rule 102 of the Public Procurement Rules 2008; or

(c) fails to furnish performance security as stated under ITT Sub-Clause 66.2, pursuant to Rule 102 of the Public Procurement Rules 2008; or

(d) refuses to sign the Contract as stated under ITT Sub-Clause 70.2 pursuant to Rule 102 of the Public Procurement Rules 2008; or

(e) does not accept the correction of the Tender price following the correction of arithmetic errors as stated under ITT Clause 55, pursuant to Rule 98(11) of the Public Procurement Rules 2008.

37. Format and Signing of Tender

37.1 Tenderers shall prepare one (1) original of the documents comprising the **Technical Offer** as described in ITT Clause 24.2 and clearly mark it "**ORIGINAL OF TECHNICAL OFFER**" In addition, the Tenderers shall prepare the number of copies of the Technical Offer, as specified in the **TDS** and clearly mark each of them "**COPY OF THE TECHNICAL OFFER**." In the event of any discrepancy between the original and the copies, the **ORIGINAL** shall prevail.

37.2 Tenderers shall prepare one (1) original of the documents comprising the Financial Offer as described in ITT Clause 24.3 and clearly mark it "**ORIGINAL OF FINANCIAL OFFER**" In addition, the Tenderers shall prepare the number of copies of the Financial Offer, as specified in the **TDS** and clearly mark each of

them "**COPY OF THE FINANCIAL OFFER**" In the event of any discrepancy between the original and the copies, the **ORIGINAL** shall prevail.

37.3 Alternatives, if permitted under ITT Clause 25, shall be clearly marked "Alternative".

37.4 The original and each copy of the Offer shall be typed or written in indelible ink and shall be signed by the Person duly authorized to sign on behalf of the Tenderer. This Tender specific authorization shall be attached to the Technical Offer Submission Letter (**Form PW5A-1a**) and Financial Offer Submission Letter (**Form PW5A-1b**). The name and position held by each Person(s) signing the authorization must be typed or printed below the signature. All pages of the original and of each copy of the Tender, except for un-amended printed literature, shall be numbered sequentially and signed by the person signing the Tender.

37.5 Any interlineations, erasures, or overwriting will be valid only if they are signed or initialled by the Person (s) signing the Tender.

E. Tender Submission

38. Sealing, Marking and Submission of Tender

38.1 Tenderers shall enclose the original of **Technical Offer** in one (1) envelope and all the copies of the **Technical Offer**, including the alternatives, if permitted under ITT Clause 25, in another envelope, duly marking the envelopes as "**ORIGINAL OF TECHNICAL OFFER**" "**ALTERNATIVES**" (if permitted), "**COPY OF TECHNICAL OFFER","ALTERNATIVES" (if permitted)** These sealed envelopes for the original and copies of the technical Tender shall then be enclosed and sealed in one single envelope and clearly mark it "**Envelope-01: TECHNICAL OFFER".**

38.2 The inner and outer envelopes of Technical Offer shall:

(a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 39.1;

(b) bear the name of the Tender and the Tender Number as stated under ITT Sub Clause 1.1;

(c) bear the name and address of the Tenderer;

(d) bear a statement "DO NOT OPEN BEFORE ----------" the time and date for Tender opening as stated under ITT Sub Clause 45.2

(e) bear any additional identification marks as specified in the **TDS.**

38.3 Tenderers shall enclose the original of **Financial Offer** in one (1) envelope and all the copies of the **Financial Offer** in another envelope, duly marking the envelopes as "**ORIGINAL OF FINANCIAL OFFER**" & "**COPY OF FINANCIAL OFFER".** These sealed envelopes for the original and copies of the Financial Tender shall then be enclosed and sealed in one single envelope and clearly mark it "**ENVELOPE-02: FINANCIAL OFFER.**

38.4 The inner and outer envelopes of Financial Offer shall:

(a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 39.1;

(b) bear the name of the Tender and the Tender Number as stated under ITT Sub Clause 1.1;

(c) bear the name and address of the Tenderer;

(d) bear a statement "**DO NOT OPEN BEFORE THE TECHNICAL OFFER EVALUATION AND APPROVAL".**

(e) bear any additional identification marks as specified in the **TDS.**

38.5 **The Envelope-01** as stated in ITT Clause 38.1 and **Envelope-02** as in ITT Clause 38.3 shall then be enclosed and sealed in one single outer envelope which shall contain the information as stated under ITT Clause 38.2 (a) to (e) & ITT Clause 38.4 (a) to (e)

38.6 Tenderers are solely and entirely responsible for pre-disclosure of Tender information if the envelope(s) are not properly sealed and marked.

38.7 Tenders shall be delivered by hand or by mail, including courier services at the address(s) as stated under ITT Sub Clause 39.1.

38.8 The Procuring Entity will, on request, provide the Tenderer with acknowledgement of receipt showing the date and time when it's Tender was received.

39. Deadline for Submission of tenders

39.1 Tenders shall be delivered to the Purchaser at the address specified in the **TDS** and no later than the date and time specified in the **TDS**.

39.2 The Purchaser may, at its discretion on justifiably acceptable grounds duly recorded, extend the deadline for submission of Tender as stated under ITT Sub Clause 39.1, in which case all rights and obligations of the Purchaser and Tenderers previously subject to the deadline will thereafter be subject to the new deadline as extended.

39.3 If submission of Tenders is allowed in more than one location, the date and time, for submission of Tenders for both the primary and the secondary place(s), shall be the "**same and not different**" as specified in the **TDS.**

39.4 The Procuring Entity shall ensure that the Tenders received at the secondary place(s) are hand-delivered at the primary place as stated under ITT Sub Clause 39.1, within THREE (3) HOURS after the deadline for submission of Tenders at the secondary place (s), in case of MULTIPLE DROPPING as stated under ITT Sub Clause 39.3, as specified in the **TDS**.

40. Late tender

37.6 Any Tender received by the Purchaser after the deadline for submission of Tenders as stated under ITT Clause 39, shall be declared LATE, rejected, returned unopened to the Tenderer.

41. Modification, Substitution or Withdrawal of Tenders

41.1 Tenderers may modify, substitute or withdraw its Tender after it has been submitted by sending a written notice duly signed by the authorized signatory and properly sealed, and shall include a copy of the authorization; provided that such written notice

including the **affidavit** is received by the Procuring Entity prior to the deadline for submission of Tenders as stated under ITT Clause 39

42. Tender Modification

42.1 Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit corresponding modification either to its original **Technical Offer** or **Financial Offer** or both, marked as **"MODIFICATION FOR TECHNICAL OFFER(MTO)" or "MODIFICATION FOR FINANCIAL OFFER (MFO)"**with two separate envelopes. The envelope/envelopes marked as MTO and/or MFO then be enclosed and sealed in one single outer envelope with a written notice duly as stated under ITT Sub Clause 41.1. The outer envelope shall contain the information as stated under ITT Sub Clause 38.2(a) to (d) and clearly marked as **"MODIFICATION (M)".**

43. Tender Substitution

43.1 Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit another **Technical Offer** or **Financial Offer** or both, marked as **"SUBSTITUTION FOR TECHNICAL OFFER (STO)" or "SUBSTITUTION FOR FINANCIAL OFFER (SFO)"**with two separate envelopes. The envelope/envelopes marked as STO and/or SFO then be enclosed and sealed in one single outer envelope with a written notice duly as stated under ITT Sub Clause 41.1. The outer envelope shall contain the information as stated under ITT Sub Clause 38.2(a) to (d) and clearly marked as **"SUBSTITUTION (S)".**

44. Withdrawal of Tender

44.1 The Tenderer shall be allowed to withdraw its Tender by a Letter of Withdrawal marked as "WITHDRAWAL" prior to the deadline for submission of Tenders as stated under ITT Clause 39.

F. Tender Opening and Evaluation

45. Tender Opening

45.1 Only the **Technical Offer (Envelope-01**) shall be opened immediately after the deadline for submission of Tenders at the primary place as specified in the **TDS** but not later than **ONE HOUR,** after expiry of the submission deadline at the same primary place unless otherwise stated under ITT Sub Clause 39.2. But with in **THREE HOURS** after the dateline of submission of tender at primary place in case of multiple dropping. Tender opening shall not be delayed on the plea of absences of Tenderers or his or her representatives. Financial offer **(Envelope-02)** shall not open with Technical offer (**Envelope-01)** and shall be kept unopened at the Custody of the Head of the Procuring Entity or his Authorised Officer (AO).

45.2 Persons not associated with the Tender may not be allowed to attend the public opening of Technical Offers.

45.3 Tenderers' representatives shall be duly authorised by the Tenderer. Tenderers or their authorised representatives will be allowed to attend and witness the opening of **Technical Offers**, and will sign a register evidencing their attendance. Technical Offers Opening shall not be delayed on the plea of absence of Tenderers or his or her representatives.

45.4 The authenticity of withdrawal or substitution of, or modifications to original Tender, if any made by a Tenderer in

specified manner, shall be examined and verified by the Tender Opening Committee (TOC) based on documents submitted as stated under ITT Sub Clause 41.1. Any envelope related to financial modification, substitute shall be recorded but not open with technical offer.

45.5 Verify (**M), (S), (W), (A), (O) by following step by steps**

(a) **Step 1:** envelopes marked "**Withdrawal (W)"** shall be opened and "Withdrawal" notice read aloud & recorded in the opening sheet. After verify the withdrawal letter is genuine, corresponding tender shall not be opened, but returned unopened to the Tenderer by Procuring Entity (**PE**) at a late time. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice shall be as stated in 41.1& 44.1 and in such case the Tender shall be opened and recorded.

(b) **Step 2:** the remaining Tenders will be sorted out and those marked **"SUBSTITUTION (S)"** or "**MODIFICATION (M)"** of Tender will be linked with their corresponding Original Tender.

(c) **Step 3:** outer envelopes marked "**SUBSTITUTION (S)**" shall be opened. The inner envelopes containing the "Substitution of Technical Offer (**STO**)" and/or "Substitution of Financial Offer (**SFO**)" shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Tenderer unopened by the Procuring Entity at a later time immediately after opening of Technical Offers. Only the Substitution of Technical Offer, if any, shall be opened, read out, and recorded. Substitution of Financial Offer will remain unopened in accordance with ITT Sub Clause 45.1. No envelope shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at Technical Offer opening.

(d) **Step 4:** outer envelopes marked "**MODIFICATION (M)**" shall be opened. No Technical Offer and/or Financial Offer shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Offers. Only the Technical Offers, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Financial Offers, both Original as well as Modification, will remain unopened in accordance with ITT Sub Clause 45.1

(e) **Step5:** if so specified in this Tender Document, the envelopes marked "Alternative of Technical Offer (ATO)" shall be opened and read aloud with the corresponding Technical Offer and recorded.

45.6 Ensuring that only the correct (**MTO), (STO), (ATO), (OTO)** envelopes are opened, details of each Technical Offer will be dealt with as follows:

(a) the Chairperson of the **TOC** will read aloud each Technical Offer and record in the Technical Offer Opening Sheet (**TOOS):**

(i) the name and address of the Tenderer;

(ii) state if it is a withdrawn, modified, substituted or original Technical Offer;

(iii) any alternatives;

(iv) record the rejection of the Tender which submitted Technical Offer and Financial Offer together in one envelope.

(v) the presence or absence of any requisite Tender Security; and

(vi) such other details as the Procuring Entity, at its discretion, may consider appropriate.

(b) Only Technical Offer and alternatives read aloud at the Technical Offer Opening will be considered in evaluation.

(c) all pages of the original version of the Technical Offer, except for un-amended printed literature, will be initialled by members of the TOC**. Remember, No financial Offer shall be open with Technical Offer**

45.7 Upon completion of Technical Offer opening, all members of the **TOC** and the Tenderers or Tenderer's duly authorised representatives attending the Technical Offer opening shall sign by name, address, designation, the TOS, copies of which shall be issued to the Head of the Procuring Entity or an officer authorised by him or her and also to the members of the TOC and any authorised Consultants and, to the Tenderers immediately.

45.8 The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record under ITT Sub Clause 45.7

45.9 No Tender i.e., Technical or Financial Offer shall be rejected at the Tender opening stage except the **LATE** Tenders as stated in the ITT Clause 40.

46. Evaluation of Tenders

46.1 Technical Offers shall be examined and evaluated only on the basis of the criteria specified in the Tender Document.

46.2 **Tender Evaluation Committee** (**TEC**) shall examine, evaluate and compare Tenders that are responsive to the requirements of Tender Documents in order to identify the successful Tenderer.

47. Evaluation Process

47.1 TEC may consider a Tender Offer as responsive in the Evaluation, only if it is submitted in compliance with the mandatory requirements set out in the Tender Document. The evaluation process should begin immediately after Technical Offer opening following Two steps:

(a) Preliminary examination

(b) Technical examination and responsiveness

48. Preliminary Examination

48.1 Compliance, adequacy and authenticity of the documentary evidences for meeting the qualification criterion specified in the corresponding section of the Tender document shall have to be preliminarily examined and verified.

48.2 The TEC shall firstly examine the Tenders to confirm that all documentation requested in ITT Clause 24 has been provided. Examination of the compliance, adequacy and authenticity of the

documentary evidence may follow the order below:

(a) verification of the completeness of the eligibility declaration in the Tender Submission Letter (Form PG5A-1), to determine the eligibility of the tenderer as stated under ITT Sub-Clause 24(h). Any alterations to its format, filling in all blank spaces with the information requested, failing which the tender may lead to rejection of the Tender;

(b) verification of that the Tenderer is enrolled in the relevant professional or trade organisations as stated under ITT Clause 24(l);

(c) verification of the eligibility in terms of legal capacity and fulfilment of taxation obligation by the tenderer in accordance as stated under ITT Sub-Clause 24(i) and 24(k);

(d) verification of eligibility that the tenderer is not insolvent, in receivership, bankrupt, not in the process of bankruptcy, not temporarily barred as stated under ITT Sub-Clause 24(j);

(e) verification of eligibility of Tenderer's country of origin as stated under ITT Sub-Clause 24(b);

(f) verification of the written authorization confirming the signatory of the Tenderer to commit the Tender has been attached with Tender Submission Letter (Form PG5A-1) as stated under ITT Sub-Clause 24(g); in order to check the authenticity of Tender and Tenderer itself ;

(g) verification of the Tender Security as stated under ITT Sub-Clause 24(d); and

48.3 The TEC shall confirm that the above documents and information have been provided in the Tender and the completeness of the documents and compliance of instructions given in corresponding ITT Clauses shall be verified, failing which the tender shall be considered rejection of that tender.

49. Technical Evaluation and Responsiveness

49.1 Only those Tenders surviving preliminary examination need to be examined in this phase.

49.2 Secondly, the TEC will examine the adequacy and authenticity of the documentary evidence which may follow the order below:

(a) verification of the completeness of the country of origin declaration in the Price Schedule for Plant and Services (Form PG5A-3) as furnished in Section 5: Tender and Contract Forms to determine the eligibility of the Goods and Related Services as stated under ITT Sub Clause 24(m).

(b) verification and examination of the documentary evidence and completed Technical Proposal (Form PG5A-4) as furnished in Section 5: Tender and Contract Forms to establish the conformity of the Goods and Related Services to the Tender Documents as stated under ITT Sub Clause 24(e) and 24(n).

(c) verification and examination of the documentary evidence that the Tenderer's qualifications conform to the Tender Documents and the Tenderer meets each of the qualification criterion specified in Sub-Section C, Qualification Criteria as stated under ITT Sub Clause 24(o).

(d) verification and examination of the documentary evidence that Tenderer has met all the requirements in regards under Section 6, Employer's Requirements, without any material deviation or reservation.

(e) verification and examination of the documentary evidence and completed Specification Submission Sheet **(Form PG5A-4a**) to determine the conformity of the Goods and related services .

49.3 TEC may consider a Tender as responsive in the evaluation, only if comply with the mandatory requirements as stated under Clause 49.2.

49.4 The TEC's determination of a Tender's responsiveness is to be based on the documentary evidence as requested in Clause 49.2 without recourse to extrinsic evidence.

49.5 Information contained in a Tender, that was not requested in the Tender Document shall not be considered in evaluation of the Tender.

49.6 If a Tender is not responsive to the mandatory requirements set out in the Tender Document it shall be rejected by the TEC and shall not subsequently be made responsive by the Tenderer by correction of the material deviation, reservation.

49.7 A material deviation or reservation is one-

(a) which affects in any substantial way the scope, quality, or performance of the Goods and Related Services and Tenderer's qualifications mentioned in the Tender Document

(b) which limits in any substantial way, inconsistent with the Tender Documents, the Purchaser's rights or the Tenderer's obligations under the Contract; or

(c) whose rectification would anyway affect unfairly the competitive position of other Tenderers presenting responsive Tenders.

49.8 During the evaluation of Tender, the following definitions apply:

(a) Deviation" is a departure from the requirements specified in the Tender Document;

(d) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Tender Document;

49.9 A TEC may regard a Tender as responsive, even if it contains-minor or insignificant deviations, which do not meaningfully alter or depart from the technical specifications, characteristics and commercial terms and conditions or other requirements set out in the Tender Document; errors or oversights, which if corrected, would not alter the key aspects of the Tender.

50. Clarification on Technical Offer

50.1 TEC may ask Tenderers for clarification of their Technical Offers in order to facilitate the examination and evaluation of Technical Offers. The request for clarification by the TEC and the response from the Tenderer shall be in writing, and Technical Offers clarifications which may lead to a change in the substance of the Technical Offers or in any of the key elements of the Technical Offers as stated under ITT Sub Clause 49.2, will neither be sought nor be permitted.

50.2 Any request for clarifications by the TEC shall not be directed towards making an apparently non-responsive Tender responsive and reciprocally the response from the concerned Tenderer shall not be articulated towards any addition, alteration or modification to its Technical Offer.

50.3 If a Tenderer does not provide clarifications of its Technical Offer by the date and time, its Tender shall not be considered in the evaluation

51. Restrictions on Disclosure of Information

51.1 Following the opening of Technical Offers until issuance of Notification of Award no Tenderer shall, unless requested to provide clarification to its Tender or unless necessary for submission of a complaint, communicate with the concerned Procuring Entity

51.2 Tenderers shall not seek to influence in anyway, the examination and evaluation of the Tenders

51.3 Any effort by a Tenderer to influence the Procuring Entity in its decision concerning the evaluation of Tenders, Contract awards may result in the non-responsiveness of its Tender as well as further action in accordance with Section 64 (5) of the Public Procurement Act, 2006.

51.4 All clarification requests shall remind Tenderers of the need for confidentiality and that any breach of confidentiality on the part of the Tenderer may result in their Tender being non-responsive.

52. Approval of Technical Offer

52.1 TEC shall prepare the Technical Offer Evaluation Report and shall directly submit the Evaluation Report to the Head of the Procuring Entity **(HOPE) or Authorized Officer for approval.**

53. Financial Offer Opening

53.1 After receiving approval of the Technical Offer Evaluation Report, Financial Offer **(Envelope-2)** of only the Responsive Tenderers who have been determined as qualified to the requirements of the Technical Offer, shall be opened publicly, The Date, time and place of Financial Offer Opening shall be communicated to the Responsive Tenderers in writing by issuing a Financial Offer Opening notice not less than **SEVEN DAYS** before the opening.

53.2 Ensuring that only the correct **MFO, SFO, OFO** envelopes of the Responsive Tenderers shall be opened, in the presence of the Responsive Tenderer's representatives who choose to attend, on the date, time and at the place as notified by the Procuring Entity in accordance with ITT Clause 53.1. Details of each Financial Offer will be dealt with as follows:

(a) the Chairperson of the Tender Evaluation Committee will read aloud each Financial Offer and record in the Financial Offer Opening Sheet (**FOOS**):

(i) the name and address of the Tenderer;

(ii) state if it is a modified, substituted or original Financial Offer;

(iii) the Tender Price;

(iv) the number of initialled corrections;

(v) any discounts; and

(vi) any other details as the Procuring Entity, at its discretion, may consider appropriate

(b) only the discounts and alternatives read aloud and recorded at the Financial Offer Opening will be considered in Financial Offer Evaluation. No Tenders shall be rejected at the opening of the Financial Offer.

(c) all pages of the original version of the Financial Offer, except for un-amended printed literature, will be initialled by members of the Tender Evaluation Committee.

(d) The Procuring Entity shall, in writing, notify the Non-responsive Tenderers who have not been determined as qualified to the requirements of the Technical Offer and shall return their Financial Offers (Envelope-02) unopened after signing of the contract.

54. Clarification on Financial Offer

54.1 TEC may ask Tenderers for clarification of their Financial Offers, about the breakdowns of unit rates, in order to facilitate the examination and evaluation of Financial Offers. The request for clarification by the TEC and the response from the Tenderer shall be in writing.

54.2 Changes in the Tender price shall not be sought or permitted, except to confirm the correction of arithmetical errors discovered by the TEC in the evaluation of the Tenders, as stated under ITT Sub Clause 55.1.

54.3 If a Tenderer does not provide clarifications of its Financial Offer by the date and time, its Tender shall not be considered in the evaluation.

54.4 Requests for clarifications on Financial Offers shall be duly signed only by the TEC Chairperson.

55. Correction of Arithmetical Errors

55.1 The TEC shall correct any arithmetic errors that are discovered during the examination of Tenders, and shall promptly notify the concerned Tenderer(s) of any such correction(s) pursuant to Rule 98(11) of the Public Procurement Rule, 2008.

55.2 Provided that the Tender is responsive, TEC 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 TEC there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted will govern and the unit price will be corrected;

(b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the sub-totals shall prevail and the total shall be corrected.

55.3 Any Tenderer that does not accept the correction of the Tender amount following correction of arithmetic errors as determined by the application of ITT Sub-Clause 55.2 shall be considered as non-responsive.

56. Conversion to Single Currency

56.1 For evaluation and comparison purpose, TEC shall convert all Tender prices expressed in the amounts in various currencies into an amount in Bangladeshi Taka currency, using the **selling exchange rates** established by the Bangladesh Bank, on the date of **Tender opening**.

57. Financial Evaluation

57.1 Thirdly the TEC, pursuant to Rule 98 of the Public Procurement Rules, 2008 shall evaluate each Tender that has been determined, up to this stage of the evaluation, to be responsive to the mandatory requirements in the Tender Document..

57.2 To evaluate a Tender in this stage , the Purchaser shall consider the following

(a) Verification and examination of the Price Schedule for Plant and Services (Form PG5-3) as furnished by the Tenderer and checking the compliance with the instructions provided under ITT Clause 26;

(b) Evaluation will be done for Items or lot by lot as stated under ITT Clause 26 and the Total Tender Price as quoted in accordance with Clause 26;

(c) Adjustment for correction of arithmetical errors as stated under ITT Sub-Clause 55.2;

(d) Adjustment for price modification offered as stated under ITT Clause 41;

(e) Adjustment due to discount as stated under ITT Sub-Clauses 26.11 and 57.3;

(f) Adjustment due to the application of economic factors of evaluation as stated under ITT Sub-Clause 57.5 if any;

(g) Adjustment due to the assessment of the price of un priced items as stated under ITT Clause 58 if any;

57.3 If Tenders are invited for a single lot or for a number of lots as stated under ITT Sub-clauses 26.10, TEC shall evaluate only lots that have included at least the percentage of items per lot. The TEC shall evaluate and compare the Tenders taking

into account:

(a) Lowest evaluated tender for each lot ;

(b) The price discount/reduction per lot;

(c) Least cost combination for the Purchaser, considering discounts and the methodology for its application as stated under ITT Sub-clauses 26.10 and 26.11 offered by the Tenderer in its Tender.

57.4 Only those spare parts and tools which are specified as a item in the List of Goods and Related Services in Section 6, Employer's Requirement or adjustment as stated under ITT Sub-clause 54.5, shall be taken into account in the Tender evaluation. Supplier-recommended spare parts for a specified operating requirement as stated under ITT Sub-clause 28.2(b) shall not be considered in Tender evaluation.

57.5 The Purchaser's evaluation of a tender may require the consideration of other factors, in addition to the Tender Price quoted as stated under ITT Clause 26. The effect of the factors selected, if any, shall be expressed in monetary terms to facilitate comparison of tenders. The factors, methodologies and criteria to be used shall be as specified in **TDS**. The applicable economic factors, for the purposes of evaluation of Tenders shall be:

(a) djustment for Deviations in the Delivery and Completion Schedule.

(b) ost of major replacement components, mandatory spare parts, and service.

57.6 Variations, deviations, and alternatives and other factors which are in excess of the requirements of the Tender Document or otherwise result in unsolicited benefits for the Purchaser will not be taken into account in Tender evaluation.

58. Price Comparison

58.1 The TEC shall compare all responsive Tenders to determine the lowest-evaluated Tender, as stated in ITT 57.2.

58.2 In the extremely unlikely event that there is a tie for the lowest evaluated price, the Tenderer with the superior past performance with the Purchaser shall be selected, whereby factors such as delivery period, quality of Goods delivered, complaints history and performance indicators could be taken into consideration.

58.3 In the event that there is a tie for the lowest price and none of the Tenderers has the record of past performance with the Purchaser, then the Tenderer shall be selected, subject to firm confirmation through the Post-qualification process described in ITT Clause 61, after consideration as to whether the quality of Goods that is considered more advantageous by the end-users.

58.4 The successful Tenderer as stated under ITT Sub Clauses 58.1, 60.2 and 60.3 shall not be selected through lottery under any circumstances.

59. Post-qualification

59.1 After determining the lowest-evaluated responsive tender as sated under ITT Sub-Clause 58.1, the Purchaser's TEC pursuant to Rule 100 of the Public Procurement Rules, 2008, shall carry out the Post-Qualification of the Tenderer, using only the requirements specified in Sub-Section C, Qualification Criteria.

59.2 The TEC shall contact the references given by Tenderers about their previous Supply experiences to verify, if necessary, statements made by them in their Tender and to obtain the most up-to-date information concerning the Tenderers.

59.3 The TEC may visit the premises of the Tenderer as a part of the post-qualification process, if practical and appropriate, to verify information contained in its Tender.

59.4 The TEC shall determine to its satisfaction whether the Tenderer that is selected as having submitted the lowest evaluated responsive Tender is qualified to perform the Contract satisfactorily.

59.5 The objective of any visit under ITT Sub-Clause 59.3 shall be limited to a general and visual inspection of the Tenderer's facilities and its plant and equipment, and there shall be no discussion concerning the Tender or its evaluation with the Tenderer during such visit(s).

59.6 In the event that the Tenderer with lowest evaluated cost fails the post-qualification, the TEC shall make a similar determination for the Tenderer offering the next lowest evaluated cost and so on from the remaining responsive Tenders, provided that,

(a) such action shall only be taken if the evaluated costs of the Tenders under consideration are acceptable to the Purchaser;

(b) when the point is reached whereby the evaluated costs of the remaining responsive Tenders are significantly higher than that of the official estimate, or the market price, the Purchaser may take action pursuant to Rule 33 of the PPR 2008 and may proceed for re-Tendering, using a revised Tender Document designed to achieve a more successful result.

60. Negotiation

60.1 No negotiations shall be held during the financial offer evaluation or award, with the lowest or any other Tenderer.

60.2 The Procuring Entity through the TEC may, however, negotiate with the lowest evaluated Tenderer with the objective to reduce the Contract Price by reducing the scope of works or a reallocation of risks and responsibilities, only when it is found that the lowest evaluated Tender is significantly higher than the official estimated cost; the reasons for such higher price being duly investigated.

60.3 If the Procuring Entity decides to negotiate for reducing the scope of the requirements under ITT Sub Clause 60.2, it will be required to guarantee that the lowest Tenderer remains the lowest Tenderer even after the scope of work has been revised and shall further be ensured that the objective of the Procurement will not be seriously affected through this reduction.

60.4 In the event that the Procuring Entity decides because of a high Tender price to reduce the scope of the requirements to meet the available budget, the Tenderer is not obliged to accept the award and shall not be penalised in any way for un-accepting the proposed award.

61. Rejection of All Tenders

61.1 The Purchaser may, in the circumstances as stated under ITT Sub-Clause 61.2 and pursuant to Rule 33 of the Public Procurement Rules 2008, reject all Tenders following recommendations from the Tender Evaluation Committee only after the approval of such recommendations by the Head of the Purchaser.rejected, if –

61.2 All Tenders can be rejected, if -

(a) the price of the lowest evaluated Tender exceeds the official estimate, provided the estimate is realistic; or

(b) there is evidence of lack of effective competition; such as non-participation by a number of potential Tenderers; or

(c) the Tenderers are unable to propose completion of the delivery within the stipulated time in its offer, though the stipulated time is reasonable and realistic; or

(d) all Tenders are non-responsive; or

(e) evidence of professional misconduct, affecting seriously the Procurement process, is established pursuant to Rule 127 of the Public Procurement Rules, 2008.

61.3 Notwithstanding anything contained in ITT Sub-Clause 61.2 Tenders may not be rejected if the lowest evaluated price is in conformity with the market price.

61.4 A Purchaser may pursuant to Rule 35 of the Public Procurement Rules, 2008, on justifiable grounds, annul the Procurement proceedings prior to the deadline for the submission of Tenders.

61.5 All Tenders received by the Purchaser shall be returned unopened to the Tenderers in the event Procurement proceedings are annulled under ITT Sub-Clause 61.4.

62. Informing Reasons for Rejection

62.1 Notice of the rejection, pursuant to Rule 35 of the Public Procurement Rules, 2008, will be given promptly within **seven (7) days** of decision taken by the Purchaser to all Tenderers and, the Purchaser will, upon receipt of a written request, communicate to any Tenderer the reason(s) for its rejection but is not required to justify those reason(s).

G. Contract Award

63. Award Criteria

63.1 The Purchaser shall award the Contract to the Tenderer whose offer is responsive to the Tender Document and that has been determined to be the lowest evaluated Tender, provided further that the Tenderer is determined to be Post-Qualified as stated under ITT Clause 59.

63.2 A Tenderer shall not be required, as a condition for award of contract, to undertake obligations not stipulated in the Tender Document, to change its price, or otherwise to modify its Tender.

64. Notification of Award

64.1 Prior to the expiry of the Tender validity period and within **seven (7)** working days of receipt of the approval of the award by the Approving Authority, the Purchaser pursuant to Rule 102 of the Public procurement Rules, 2008, shall issue the Notification of Award (NOA) to the successful Tenderer.

64.2 The Notification of Award, attaching the contract as per the sample (**Form PG5A-7)** to be signed, shall state:

(a) the acceptance of the Tender by the Purchaser;

(b) the price at which the contract is awarded;

(c) the amount of the Performance Security and its format;

(d) the date and time within which the Performance Security shall be submitted; and

(e) the date and time within which the contract shall be signed.

64.3 The Notification of Award shall be accepted in writing by the successful Tenderer within **seven (7)** working days from the date of issuance of **NOA.**

64.4 Until a formal contract is signed, the Notification of Award shall constitute a Contract, which shall become binding upon the furnishing of a Performance Security and the signing of the Contract by both parties.

64.5 The Notification of Award establishes a Contract between the Purchaser and the successful Tenderer and the existence of a Contract is confirmed through the signature of the Contract Document that includes all agreements between the Purchaser and the successful Tenderer.

65. Performance Security

65.1 The Performance Security shall be determined sufficient to protect the performance of the Contract pursuant to Rule 27 of the Public Procurement Rules, 2008.

65.2 Performance Security shall be furnished by the successful Tenderer in the amount specified in the **TDS** and **denominated in the currencies** in which the Contract Price is payable pursuant to Rule 102 (8) of the Public Procurement Rules, 2008.

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

66. Form and Time Limit for furnishing of Performance security

66.1 The Performance Security shall be in the form of irrevocable Bank Guarantee in the format (Form PG5A-9) as stated under ITT Clause 65, shall be issued by an internationally reputable bank and it shall have correspondent bank located in Bangladesh, to make it enforceable pursuant to Rule 27(4) of the Public Procurement Rules, 2008..

66.2 Within twenty-eight (28) days from issue of the Notification of Award, the successful Tenderer shall furnish the Performance Security for the due performance of the Contract in the amount specified under ITT Sub Clause 65.2.

67. Validity of Performance Security

67.1 The Performance Security shall be required to be valid until a date twenty-eight (28) days beyond the date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations.

67.2 If under any circumstances date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations is to be extended, the Performance Security shall correspondingly be extended for the extended period.

68. Authenticity of performance Security

69.1 The Purchaser shall verify the authenticity of the Performance Security submitted by the successful Tenderer by sending a written request to the branch of the bank issuing irrevocable Bank Guarantee in specified format.

69.2 If the Performance Security submitted under ITT Sub Clause 65.2 is not found to be authentic, the Purchaser shall proceed to take measures against the Tenderer in accordance with Section 64 of the Act and pursuant to Rule 127 of the Public Procurement Rules, 2008.

69. Contract Signing

69.1 At the same time as the Purchaser issues the Notification of Award, the Purchaser shall send the draft Contract Agreement and all documents forming the Contract pursuant to Rule 102 of the Public Procurement Rule, 2008, to the successful Tenderer.

69.2 Within twenty-eight (28) days of the issuance of Notification of Award, the successful Tenderer and the Purchaser shall sign the contract provided that the Performance Security submitted by the Tenderer is found to be genuine.

69.3 If the successful Tenderer fails to provide the required Performance Security, as stated under ITT Clause 65 or to sign the Contract , as stated under ITT Sub-Clause 69.2, Purchaser shall proceed to award the Contract to the next lowest evaluated Tenderer, and so on, by order of ranking pursuant to Rule 102 of the Public Procurement Rules,2008.

70. Publication of Notification of Award of Contract

70.1 Notification of Awards for Contracts of Taka 10 (ten) million and above shall be notified by the Purchaser to the Central Procurement Technical Unit within 7(seven) days of issuance of the NOA for publication in their website, and that notice shall be kept posted for not less than a month pursuant to Rule 37 of the Public Procurement Rules, 2008.

70.2 Notification of Award for Contracts below Taka 10(ten) million, shall be published by the Purchaser on its Notice Board and where applicable on the website of the Purchaser and that notice shall be kept posted for not less than a month pursuant to Rule 37 of the Public Procurement Rules, 2008..

71. Debriefing of Tenderers

72.1 Debriefing of Tenderers by Purchaser shall outline the relative status and weakness only of his or her Tender requesting to be informed of the grounds for not accepting the Tender submitted by him or her pursuant to Rule 37 of the Public Procurement Rule, 2008, without disclosing information about any other Tenderer.

72.2 In the case of debriefing confidentiality of the evaluation process shall be maintained.

72. Right to Complains

72.1 Any Tenderer has the right to complain if it has suffered or likely to suffer loss or damage due to a failure of a duty imposed on the Purchaser to fulfil its obligations in accordance with Section 29 of the Public Procurement Act 2006 and pursuant to Part 12 of Chapter Three of the Public Procurement Rules, 2008.

72.2 Circumstances in which a formal complaint may be lodged in sequence by a potential Tenderer against a Purchaser pursuant to Rule 56 of the Public Procurement Rules, 2008, and the complaints, if any, be also processed pursuant to Rule 57 of the Public Procurement Rules 2008.

72.3 The potential Tenderer shall submit his or her complaint in writing within seven (7) calendar days of becoming aware of the circumstances giving rise to the complaint.

72.4 In the first instance, the potential Tenderer shall submit his or her complaint to the Purchaser who issued the Tender Document.

72.5 The place and address for the first stage in the submission of complaints to the Administrative Authority is provided in the **TDS**.

72.6 The Tenderer may appeal to a Review Panel only if the Tenderer has exhausted all his or her options of complaints to the administrative authority as stated under ITT Sub-Clause 72.2.

Section 2. Tender Data Sheet

Instructions for completing the Tender Data Sheet are provided, as needed, in the notes in italics and under lined mentioned for the relevant ITT clauses.	
ITT Clause	**Amendments of, and Supplements to, Clauses in the Instruction to Tenderers**
A. General	
ITT 1.1	The Procuring Entity/Employer/Purchaser is : Bangladesh Power Development Board (BPDB) **Representative:** Secretary Bangladesh Power Development Board (BPDB) Address: WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564765 e-mail address: secretary@bpdb.gov.bd **Project Manager/Consignee:** Project Director, Power Distribution System Development, Chattogram Zone (2nd Phase), Bidduyut Bhaban (5th Floor), Agrabad BPDB, Chattogram. Camp Office: Bidduyut Bhaban (15th Floor),1 No. Abdul Goni Road, BPDB, Dhaka. E-mail: pd.pdsd2.cz@gmail.com Phone: +8801708168864, +8801708168866 **Engineer:** "Engineer" means Director, Directorate of Design & Inspection-II, 9/B, Motijheel C/A, Dhaka-1000. E-mail: dir.design2@bpdb.gov.bd, Phone: +880 2 955 0404, Fax: +880 2 955 0265. **The Name and identification number of Tender is**: **"Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 05 Nos. 33/11kV New GIS Substation, 02 Nos. 33/11kV Substation (GIS Up-gradation), 33kV Bay-Extension at 02 Nos. Substation and 33kV Underground Cable Double Circuit Source Line with Civil and other related works including automation of the Sub-station (SAS) on Turnkey Basis under Power Distribution System Development, Chattogram Zone (2nd Phase), BPDB, Chattogram." (LOT-3)** Pakage : GD-1, Lot-3 *Tender No.:* .....
ITT 1.2	The number, identification and name of lots comprising the Tender are: Single Lot on Trunkey Basis. (Lot-3)
ITT3.1	The source of public funds is Government of Bangladesh (GOB).
ITT3.3	The name of the Development Partner is **None.**
ITT5.1	Tenderers from the following countries are not eligible: Israel and countries having no diplomatic relation with the Government of Bangladesh
ITT 5.13	Tenderers shall have the following up to date valid License: Trade/Business License.

ITT6.1	Materials, Equipment and associated services from the following countries are not eligible: Israel and countries having no diplomatic relation with the Government of Bangladesh. Goods from a country which is not included in the specified countries mentioned in the respected GTP in Section 8: Guaranteed Technical Particulars is also not acceptable.
ITT 6.3 (New Clause)	Manufacturer & Tenderer has to mention only single country of origin [manufacturing country/country for major assembly] for the same manufacturer for individual specific item, otherwise his Tender/Bid shall be non-responsive.
ITT 7.5 (New Clause)	Added immediate after Clause No. 7.4 Each Tenderer before submitting his Tender will carefully examine the tender requirements and visit the site(s) to determine the existing conditions, facilities and limitations. Tenderer shall have made all necessary arrangement to carry out the Contract if awarded for the Supply & Installation of Plant & Equipment to completing the Scope of Work as described in Section 6: Employer's Requirement. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply & Installation of Plant & Equipment in case of award of the contract.
B. Tender Document	
ITT8.2	The following are the offices of the Purchaser or authorised agents for the purpose of providing the Tender Document: Agent's Name: Project Director, Power Distribution System Development, Chattogram Zone (2nd Phase), Bidduyut Bhaban (5th Floor), Agrabad BPDB, Chattogram. Camp Office: Bidduyut Bhaban (15th Floor),1 No. Abdul Goni Road, BPDB, Dhaka. E-mail: pd.pdsd2.cz@gmail.com Phone: +8801708168864, +8801708168866
ITT9.1	For **clarification of Tender Document purposes** only, the Procuring Entity"s address is: Attention: Secretary, Bangladesh Power Development Board (BPDB) Address: WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564350 e-mail address: secretary@bpdb.gov.bd
ITT10.1	A Pre- Tender meeting shall be held at- Address, Time & Date as per Tender Notice.
C. Qualification Criteria	
ITT 13.1	The maximum 3 (three) number of arbitration against the Tenderer over a period of the last 5(five) years.
ITT 14.1 (a)	The Tenderer shall have a minimum of 5 (five) years of overall experience in the role of contractor, subcontractor, or management contractor.

ITT 14.1 (b)	The minimum specific experience as a Contractor or Subcontractor or Management Contractor in similar to the proposed plant and services is as follows: i) **For 33/11KV Substation**: At least 2(two) contract(s) of similar nature*, complexity and methods/construction technology successfully completed within the last 10 (ten) years, each with a value of at least BDT 73 (Seventy Three) Crore or equivalent USD 8.5 (Eight Point Five) millions. **Similar nature means: Construction of 33/11kV or higher voltage level GIS/GIS+AIS Substation and having capacity regarding engineering, supply, erection, installation, testing and commissioning of at least 2x20/26MVA or higher capacity substations on turnkey basis.* ii) **For 33kV XLPE Power Cable**: At least 2(two) contract(s) of similar nature*, complexity and methods/construction technology successfully completed within the last 10 (ten) years, each with a value of at least BDT 46 (Fourty Six) Crore or equivalent USD 5.35 (Five point Three Point) millions. **Similar nature means: Supply, installation, testing and commissioning of at least 33kV or higher voltage level and at least 1x800mm² or higher size Underground XLPE Cable on turnkey basis.* *Note:* 1. *The Tenderer shall have to submit End User Certificate(s) in End User's official pad; in favor of above mentioned experience stating that the performance of the supplied plant and services are satisfactory at least one (01) year.* 2. *The End User Certificate(s) duly signed by the end user shall mention the name & commissioning date of the plant and services which were designed, supplied, installed/constructed, tested and commissioned by Tenderer (Lead Partner/JVCA partner in case of JV) and shall contain end-user's full mailing address, official domain e-mail address, website address, fax number and phone number for the convenience of authentication. In any case, BPDB reserve the right to verify genuineness of End User Certificate(s).* 3. *Certificate(s) those are not in Bangla/English must be notarized on translated English version.* In addition, performance of the completed turnkey contracts and ongoing turnkey contract(s) as mentioned in **Annexure: 5-1** and **Annexure: 5-2** shall be taken into consideration during evaluation.
ITT 15.1(a)	The required average annual turnover shall be greater than Tk. 240 (Two Hundred Forty) Crore or equivalent USD 35.2 (Thirty Five Point Two) million within the best three (3) years in the last five (5) years; years counting backward from the date of publication of IFT in the newspaper. *[Note: Average Annual Turnover shall be calculated as total certified payments received for contracts in progress or completed]*
ITT 15.1(b)	The minimum amount of liquid assets or working capital or credit facilities of the Tenderer must satisfy the assessment of Financial Resources Availability as mentioned in **Annexure: 5-4.** *[for Tenders where the package contains more than one (1) lot, this qualification requirements shall be mentioned separately for each lot in the package]*

ITT 16.1(a)

A Project Manager, Engineer, and other key staff shall have the following qualifications and experience:

Sl.No.	Position	Total Works Experience (Years)	Experience in similar works (Years)
01	Project Manager- 1 no.	15	05
02	Deputy Project Manager- 2 nos.	12	05
03	Design Engineer- 2 nos.	10	05
04	Electrical Engineer- 4 nos.	10	05
05	GIS Expert*- 1 no.	10	05
06	Power Transformer Expert*- 1 no.	10	05
07	Power Cable Expert*-1 no.	10	05
08	Protection/Control Engineer- 1 no.	10	05
09	Civil Engineer- 3 nos.	10	05
10	Foreman- 11 nos.	05	03
11	Technician (Auto CAD)- 2 nos.	05	02
12	Technician (Electrical)- 11 nos.	05	02
13	Site Engineer (Electrical/Mechanical/Civil)- 11 nos.	05	02

Tenderer shall provide manpower detail information in accordance of Technical proposal (Form PG5A-4) and an undertaking certificate regarding manpower that mentioned manpower will be engaged in the proposed work on dedicated basis (i.e. no involvement in any other ongoing work at the time of implementation of proposed work). ***Failure to submit or misrepresentation of the detail information for manpower, Tender shall be rejected without further evaluation.***

The tenderer shall provide details of proposed personal and CV of the employee except expertise shall be endorsed by the Tenderer in its letter head pad.

**The Tenderer shall state clearly in its Tender to the effect that installation, testing and commissioning of GIS, Power Transformer and Power Cable shall be performed by experts of relevant manufacturer. In this regard, the Tenderer shall provide CV of the expertise of the relevant manufacturer in addition to the CV of Tenderer's employee.*

Except as the Employer may otherwise agree, no changes shall be made in the Personnel. If, for any reason beyond the reasonable control of the Contractor, it becomes necessary to replace any of the Personnel, the Contractor shall forthwith provide as a replacement a person of equivalent or higher qualifications acceptable to the Employer, including prior review where necessary.

If the Employer, finds that any of the Personnel has committed serious misconduct or has been charged with having committed a criminal action; or has reasonable cause to be dissatisfied with the performance of any of the Personnel; then the Contractor shall, at the Employer's written request specifying the grounds therefore, forthwith provide as a replacement, a person with qualifications and experience, as stated under ITT 16.1, acceptable to the Employer.

[for Tenders where the package contains more than one (1) lot, this qualification requirement may be necessary for each lot in the package, subject to the nature of the control required over each package]

ITT 17.1

The Tenderer shall own or have proven access to hire or lease of the major equipment, in full working order as follows :

No	Equipment Type and Characteristics	Minimum Number Required
1	Crane 10 tons	02 set
2	Transportation Vehicles	As required
3	Relay test set	06 set
4	Primary Current Injector	06 set
5	Secondary Current Injector	06 set
6	Earth tester	05 set
7	Insulation testers (5 kV)	05 set
8	Live-Line Voltage & Current Measuring Tools	05 set
9	Power Cable Installation Tools	05 set
10	Others	As required

[for Tenders where the package contains more than one (1) lot, this qualification requirement may be necessary for each lot in the package, subject to the nature of the control required over each package]

ITT 18.1 The value of non-judicial stamp for execution of the Joint Venture Agreement shall be Tk 300 only.

ITT 18.2 Maximum number of partners in the JV shall be "not limited"

The **minimum qualification** requirements of Leading Partner, other Partner(s) and requirements by summation of a JV shall be as follows:

TDS Clauses References	Requirements by summation	Requirements for Leading Partner	Requirements for other Partner(s)
ITT-14.1(a)	Summation not applicable	Same as stated in TDS	Same as for Leading Partner
ITT-14.1(b)	100%	At least one Contract	Not applicable
ITT-15.1(a)	100%	40%	25%
ITT-15.1(b)	100%	40%	25%
ITT-16.1(a)	100%	Not applicable	Not applicable
ITT-17.1	100%	Not applicable	Not applicable

[Percent share of business of the JVCA partners shall not be taken into account in determining the qualification of a JVCA].

D.Tender Preparation

ITT 19.2 The maximum of percentage is 20% of the Contract Value of Goods allowed to be subcontracted.

ITT 19.4 The Nominated Subcontractor(s) named shall execute the following specific components of the proposed Works: ***None.***

ITT 20.1 Tenders are being invited for Single Lot [Lot-3].

ITT 24.2

The Tenderer shall prepare and submit its Tender documenting in chronological order but not limited to as following:

Envelope-1[Technical Offer]
Volume-1 of 5
Tenderer's General, Legal and Regulatory Qualification Requirement:

Sl. No.	Description	Yes	No	Page No.
1	Registration /Certificate of Incorporation /Trade licence in its country of origin / relevant documents as documentary evidence to satisfy experience criteria as stated in ITT 14.1(a).			
2	Updated VAT, TIN, TAX Certificates, NID Copy			
3	Eligibility criteria (ITT 5),			
4	Litigation history (ITT 13),			
5	Arbitration Declaration (ITT 13.1)			
6	Delegation of Power of Attorney/Authorization Letter to Sign the Bid			
7	PG5A – 1a : Tender Submission Letter for Technical Proposal			
8	PG5A – 1b: Tender Submission Letter for Financial (Price) Proposal		No	
9	PG5A – 2a : Tenderer Information Sheet			
10	PG5A – 2b: JVCA Partner Information			
11	JVCA Agreement & JVCA Criteria fulfilment declaration (Wherever applicable)			
12	List of Proposed Sub-Contractors (if any)			
13	PG5A – 2c: Subcontractor Information			
14	Financial Deviation List (if any)			
15	Bid Security Declaration (if any)			
16	PG5A – 6: Bank Guarantee for Tender Security			
17	Bill of Quantity (BOQ) as per Section 6. Employer's Requirements			
18	Country of Origin Declaration Form			
19	General Experience criteria [ITT 14.1 (a)]			
20	Tender validity declaration [ITT 30.2]			
21	Declaration of Payment Terms			

22	Tax, VAT & Insurance requirements			

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Tenderer's Financial Qualification Requirement:

Sl. No.	Description	Yes	No	Page No.
23	Financial Experience Criteria [**ITT 15.1(a)]**			
24	Information of all completed turnkey contracts in govt. entities under power sector of Bangladesh within last 10 (ten) years (end user's satisfactory performance certificate/PAC/FAC/ Completion Certificate) in the format attached as **Annexure: 5-1.**			
25	Information of all ongoing turnkey contract(s) in govt. entities under power sector of Bangladesh in the format attached as **Annexure: 5-2** with supporting document (Acceptance of NOA/Contact agreement) along with the up to date progress cum work quality certificate from end user. Also the information as required in **Annexure: 5-3 & Annexure: 5-4**			
26	Letter of Commitment (Form PG5A-6a) for credit line(s) substantiated by any schedule Bank as documentary evidence to satisfy financial criteria as stated in ITT 15.1(b).			
27	Audited Financial Reports or Cash flow statements as documentary evidence to satisfy total certified payments received for contracts in progress/completed to calculate required Average Annual Turnover as stated in ITT 15.1(a).			

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Tenderer's Organizational Profile and Human Resourcing:

Sl. No.	Description	Yes	No	Page No.
28	Organizational Profile			
29	List of Tenderer's Supply Experience			
30	Personal Information form shall be endorsed by the Tenderer on his official pad as documentary evidence to satisfy the criteria as stated in ITT 16.1(a).			
31	Equipment Information form shall be endorsed by Tenderer on his official pad as documentary evidence to satisfy the criteria as stated in ITT 16.1(b).			
32	Proveness of access to hire or lease of the major equipment, in full working order [ITT 17.1]			

33	CVs/Bio data of proposed experts			

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Technical Qualification Requirement:

Sl. No.	Description	Yes	No	Page No.
34	PG5A – 4: Technical Proposal, Work Plan and Bar Chart			
35	Technical alternative proposal (if any)			
36	Technical Deviation List (if any)			
37	Factory Acceptance Test (FAT)/Quality Acceptance Test (QAT) Schedule [GCC 38.2]			
38	List of Manufacturer's similar supplied goods			
39	Completion Schedule declaration for whole facilities [**GCC 1.1 (dd) & 24.1]**			

Volume-4 (B) of 5

Sl. No.	Description	Yes	No	Page No.
40	End User certificate as documentary evidence to satisfy experience criteria as stated in ITT 14.1(b).			
41	Manufacturer's Authorization (Form PG5A-5)			
42	Warranty Certificate (Form PG5A-12) from Tenderer as per GCC 42 and from manufacturer.			
43	Manufacturer's End user certificates [ITT 24.2 (r)]			
44	PG5A – 4a : Specification submission & compliance sheet.			
45	Guaranteed Technical Particulars (GTP)			
46	IEC 61850 Test Certificate for all Protective Relays.			
47	Manufacturer's ISO Certificate			

Volume-4 (C) of 5

Sl. No.	Description	Yes	No	Page No.
48	Type Test Reports/Certificates			

Volume-4 (D) of 5

Sl. No.	Description	Yes	No	Page No.
49	Product Brochures/Catalogue			
50	User's Manual			

Volume-4 (E) of 5

Sl. No.	Description	Yes	No	Page No.
51	Site visit Report			
52	Block Diagram, Circuit Diagram, Logic Diagram, characteristic curve, Third Party cyber security certification etc.			
53	Design calculations			
54	Design & Drawing Submission			

Volume-5 of 5

Sl. No.	Description	Yes	No	Page No.
55	Sealed & signed original Tender Document (which was issued by BPDB) including addenda.			

N.B. 1. *For each volume, it shall contain all the indexes of all volumes under the title of ''Table of Content & Checklist''*
2. For Volume 4(C) & 4 (D), the tenderer can choose to segregate of these volumes in suitable part(s) for comfortable size, if necessary.

ITT 24.2(r)

The Tenderer shall submit with its technical offer the following additional documents:

1. Tenderer shall have to submit the information of all completed turnkey contracts in govt. entities under power sector of Bangladesh within last 10 (ten) years; years counting backward from the date of publication of IFT in the newspaper, with supporting document (end user's satisfactory performance certificate/PAC/FAC/ Completion Certificate) in the format attached as **Annexure: 5-1.**
2. Tenderer shall have to submit the information of all ongoing turnkey contract(s) in govt. entities under power sector of Bangladesh in the format attached as **Annexure: 5-2** with supporting document (Acceptance of NOA/Contact agreement) along with the up to date progress cum work quality certificate from end user.
3. Sealed & signed original Tender Document (which was issued by BPDB) by a person duly authorized to sign on behalf of the tender. Copy of issued tender document will not be acceptable.
4. Registration /Certificate of Incorporation /Trade licence in its country of origin / relevant documents as documentary evidence to satisfy experience criteria as stated in ITT 14.1(a).

5. End User certificate as documentary evidence to satisfy experience criteria as stated in ITT 14.1(b).
6. Audited Financial Reports or Cash flow statements as documentary evidence to satisfy total certified payments received for contracts in progress/completed to calculate required Average Annual Turnover as stated in ITT 15.1(a).
7. Letter of Commitment (Form PG5A-6a) for credit line(s) substantiated by any schedule Bank as documentary evidence to satisfy financial criteria as stated in ITT 15.1(b).
8. Personal Information form shall be endorsed by the Tenderer on his official pad as documentary evidence to satisfy the criteria as stated in ITT 16.1(a).
9. Equipment Information form shall be endorsed by Tenderer on his official pad as documentary evidence to satisfy the criteria as stated in ITT 17.1.
10. Warranty Certificate (Form PG5A-12) from Tenderer as per GCC 42.
11. Bill of Quantity (BOQ) as per Section 6. Employer's Requirements
12. Guaranteed Technical Particulars (GTP) in Section 8 shall be properly filled up in manufacturer's official pad with submission of related supporting documents & signed by the Manufacturer & Tenderer. **All the properly filled up GTP mentioned in Section-8 shall be submitted in one book/volume of the Bid Document.**

13. At least 02 (two) nos. of Manufacturer's Supply Experience (supported by Copy of Completion Certificate from Purchaser along with NOA/ Contract Agreement/ Purchase Order and the certificate shall contain End User's full mailing address, fax/telephone number, website address, domain e-mail address for the convenience of authentication) for offered type similar or higher capacity rating 33kV Gas Insulated Switchgear (GIS), Substation Automation System (SAS), Power Transformer, Station Transformer, 33kV Outdoor VCB, 33kV PCM Panel, 11kV Gas Insulated Switchgear (GIS) with PCM Panel, Battery & Battery Charger, 33kV & 11kV XLPE Power Cable, 33kV CT & PT, 33 kV Isolators, 33 kV & 11kV LA of same voltage class within the last 05 (five) years i.e. years counting backward from the date of publication of IFT in the newspaper. Manufacturer's Supply Experience shall be furnished in the following supply record format. (The Supply Experience covering at least 25% (for 33kV, 1x800mm^2 XLPE Power Cable 5%) of the tendered quantity in a single contract will be considered only)::

Sl. No.	Name, Address, Phone & Fax No. of the Purchaser	Contract No. & Date/NOA	Contract Value	Description of materials with Quantity	Date of Completion of Supply

14. At least 02 (two) nos. Manufacturer's Satisfactory Performance Certificates from Electricity Utility as End User depicting that each offered type similar or higher capacity rating 33kV Gas Insulated Switchgear (GIS), Substation Automation System (SAS), Power Transformer, Station Transformer, 33kV Outdoor VCB, 33kV PCM Panel, 11kV Gas Insulated Switchgear (GIS) with PCM Panel, Battery & Battery Charger, 33kV & 11kV XLPE Power Cable, 33kV CT & PT, 33 kV Isolators, 33 kV

& 11kV LA of same voltage class within last 10(ten) years i.e. years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 02(two) years.

The Satisfactory Performance Certificate (SPC) shall be in End User's official pad and shall contain End User's full mailing address, fax/telephone number, website address, domain e-mail address for the convenience of authentication.

Note: Electricity Utility means an organization/company that engages in electricity generation/ transmission / distribution of electricity for sale in a regulated market.

For 33KV PCM:

15. Manufacturer's authorization in prescribed Form (PG5A-5) for
Protective Relays from ABB (Switzerland/ Sweden/Finland) or Siemens (Germany) or Schneider Electric (UK/France) or ALSTOM (UK/France) or NR (China), SEL, USA

Energy Meters from European Country/ North American Country/Japan/Australia.

16. IEC 61850 Test Certificate for all Protective Relays& IEC 61850 or Equivalent for all Energy meters for SAS Operation..

Type Test Certificates & Reports:

For 33KV Outdoor VCB :

Type Test Certificates & Reports for offered type similar or higher Ampere rating Outdoor Vacuum Circuit Breaker (VCB) for same voltage class from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory as per relevant IEC standard. The type test report along with results shall include at least the following tests:

a) Lightning Impulse Voltage withstand tests
b) Power Frequency withstand tests
c) Temperature Rise tests
d) Measurement of Resistance of the main circuit.
e) Short-time withstands current and peak withstands current tests.
f) Mechanical Endurance tests
g) Short Circuit performance tests
h) Out-of-phase making & breaking tests
i) IP55 tests.

For 33KV & 11 kV Gas Insulated Switchgear (GIS):

17. Manufacturer's authorization in prescribed Form (PG5A-5) for
Protective Relays from ABB (Switzerland/ Sweden/Finland) or Siemens (Germany) or Schneider Electric (UK/France) or ALSTOM (UK/France) or NR (China), SEL, USA

Energy Meters from European Country/ North American Country/Japan/Australia.

18. IEC 61850 Test Certificate for all Protective Relays & IEC 61850 or Equivalent for all Energy meters for SAS Operation.

19. **Type Test Certificates & Reports:**

Type Test Certificates & Reports for offered type similar or higher Ampere rating Switchgear for same voltage class from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory as per relevant IEC standard. The type test report along with results shall include at least the following tests :

a) Dielectric Test
b) Radio interference Voltage test
c) Measurement of resistance of the main circuit.
d) Temperature/ Gas pressure Rise Tests
e) Short-time withstand current and peak withstand current tests
f) Internal Arc Fault test
g) Mechanical Endurance tests.

20. IEC 61850 Test Certificate for all Protective Relays & IEC 61850 or Equivalent for all Energy meters for SAS Operation.

For Substation Automation System(SAS):

21. Manufacturer's authorization for Substation Automation System (SAS) in prescribed Form (PG5A-5).

22. The following documentation shall be provided for the system during the course of the project and they shall be consistent, CAD supported, and of similar look/feel:

- Block Diagram
- Circuit Diagram
- Test Specification for Factory Acceptance Test (FAT)
- Logic Diagram
- Third Party cyber security certification.

For Power Transformers :

23. Manufacturer's authorization for (On Load tap Changer) OLTC from MR, Germany/ ABB, Sweden/ HM, China in prescribed Form (PG5A-5).

24. GA drawing of Transformer including Cross-sectional Drawing showing the arrangement of core and windings (HT, LT, Tap) of the offered type Transformer.

25. Type Test Certificates, Reports & Special Tests for offered type similar or higher MVA rating power transformer for same voltage class from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory as per relevant IEC standard. The type test report shall include at least the following tests along with results:

a) Temperature Rise Test

b) Lightning Impulse Test
c) Short circuit withstands test report of HV-LV

26. No load loss, full load Loss calculation (i.e. I^2R loss, winding eddy current loss & Stray loss) at ONAN & ONAF condition, Short circuit calculation, temperature rise calculation (Top Oil, mean Oil, LV & HV winding at ONAN & ONAF condition for nominal Tap, minimum & maximum tap), Cooling Calculation at ONAN & ONAF condition for total losses at minimum Tap and calculation of flux density, Core diameter, Gross cross-sectional area of Core, Net cross-sectional area of Core, Core weight, Stack thickness and Mean length of core along with the drawing of window height, Core leg center. Tenderer's quoted No load Loss and Full load loss shall be supported by loss calculation. Moreover, Tenderer shall submit the characteristic curve (flux vs Loss/Kg) of core materials.

For 33kV CT & PT

27. Type Test Certificates & Reports for offered type similar or higher ampere rating CT & PT from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory or ILAC accredited independent testing laboratory as per relevant IEC standard.

For 110V DC Substation Battery & 110V DC Battery Charger

28. Type Test Certificates & Reports for offered type similar of higher ampere rating Substation Battery & 110V DC Battery Charger from any independent testing laboratory as per relevant IEC standard.

For 33KV & 11kV Surge Arrester (LA):

29. Type test report for offered type Lightning Arresterof same voltage class as per IEC 60099-4. All Type Test shall be done from any of the following independent testing laboratories:
    - I. CESI, Italy
    - II. ESEF ASEFA, France
    - III. JSTC Japan
    - IV. KEMA, The Netherlands
    - V. PEHLA, Germany
    - VI. TUV Rheinland, Germany
    - VII. SATS, Norway
    - VIII. STLNA, USA
    - IX. VEIKI, Hungary
    - X. ZKU, Czech Republic
    - XI. UL, USA

For XLPE Power Cable:

30. Type Test Certificates & Reports for XLPE insulated Copper cable of similar or higher size of similar or higher voltage class from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory or China National Center for quality Supervision and test

of electrical wire and cable as per relevant IEC standard. The type test report along with results shall include at least the following tests:

1. **Electrical type test**
   a. Bending test
   b. Partial discharge test
   c. Tan δ measurement
   d. Heating cycle test
   e. Partial discharge test
   f. Impulse test
   g. Voltage test for 4 h
   h. Resistivity of semi-conducting screens.
2. **Non Electrical type tests**
   a. Measurement of thickness of insulation
   b. Measurement of thickness of non-metallic sheaths (including extruded separation sheaths, but excluding inner coverings)
   c. Tests for determining the mechanical properties of insulation before and after ageing
   d. Tests for determining the mechanical properties of non-metallic sheaths before and after ageing
   f. Additional ageing test on pieces of completed cable
   g. Loss of mass test on PVC sheaths
   h. Pressure test at high temperature on insulation and non-metallic sheaths
   i. Test on PVC insulation and sheaths at low temperature
   j. Test for resistance of PVC sheaths to cracking (heat shock test)
   k. Hot set test for XLPE insulation
   l. Water absorption test on insulation
   m. Flame spread test on single cables
   n. Shrinkage test for XLPE insulation
   o. Strip ability test for insulation screen.

31. Short circuit earth fault current with details Calculation for metallic screen.

32. Detail cross sectional drawing of the offered type cable showing dimension & identification name.

For 33kV & 11 kV XLPE Copper Cable Termination Kit

33. The test certificate and reports as per relevant IEC 60502-4 for the offered type 33kV & 11 kV XLPE Copper Cable Termination Kit shall be submitted with the offer from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory or ILAC accredited independent testing laboratory and the report shall include at least the following test:

    a) AC Voltage withstand (dry)
    b) AC Voltage withstand (wet)
    c) Partial Discharge.
    d) Impulse Voltage withstand
    e) Thermal Cycle
    f) Humidity (for Indoor type)
    g) Thermal Short-circuit.
    h) Dynamic Short-circuit.

For 33kV Isolator with/without Earth Blade:

	34. The following test certificate along with test results for offered type Isolator confirming to the tender document shall be submitted with the offer from internationally reputed Independent testing laboratory or reputed & renowned testing laboratory as per relevant IEC Standard, otherwise the bid will be rejected. a) Short time & peak withstand current. b) Resistance measurement of the main circuit. c) Temperature rise. d) Lightning Impulse Voltage withstand. e) Dielectric test f) Operating and mechanical endurance test g) verification of the protection h) Operation at the temperature limits *Note: If required, Purchaser will authenticate Type Test/Calibration Certificates & Reports from the Certificates & Reports issuing laboratory and if any applicable charge /cost impose by issuing laboratory for said authentication shall be borne by Tenderer. The certificates and Reports shall contain laboratory's full mailing address, e-mail address, website address and fax/telephone number for the convenience of authentication. If these information are not mentioned in the Certificates & Reports, all these information should be mentioned in the Letterhead pad of the manufacturer duly seal & signed by the manufacturer representative.* **Others:** 35. The Tenderer shall mention maximum days required to complete the supply of equipment/ materials (at site) and maximum days required for the completion of actual design, erection, installation, testing, commissioning & Civil work in bar chart form within the completion time. 36. All Tender Forms without any alteration of given format. 37. Site visit Report.
24.3(d)	The Tenderer shall submit with its financial offer the following additional documents: **None**
ITT 25.1	Alternatives shall be permitted. [*Note: "A tenderer may submit alternatives only with a tender for the base case. The Purchaser shall only consider the alternatives offered by the Tenderer whose tender for the base case was determined to be the lowest responsive evaluated tender."* *"Offer of alternatives shall be permitted only for alternative technical specification complying with base technical specification parameter and employer's requirement specified in the tender documents."]*
ITT 26.1	Tenderers shall quote for the entire Plant and Installation Services on a single responsibility basis.
ITT 26.5(a)	Price of Plant and Mandatory Spare parts shall be quoted on CIP. Port of Landing: Any port of Chittagong/Dhaka/Khulna (Mongla)/Benapole. Place of Destination: Project site or Project Store, Chattogram (Phase-2) or BPDB's store near to the substation sites or any store/place as directed by Consignee.
ITT	Local transportation to named place of final destination is: Project site.

26.5(e)	
ITT 26.7	The prices quoted by the Tenderer shall be fixed for the duration of the Contract.
ITT 27.4	Name of the foreign currency: USD/EUR/GBP/JPY.
ITT 28.1 (b)	Spare parts are: Required as per BOQ. Period of time the Equipment are expected to be functioning (for the purpose of spare parts): 20 (Twenty) years from issuing date of FAC. *[Note: Such spare parts as the Purchaser may elect to purchase from the supplier, provided that this election shall not relieve the supplier of any warranty obligations under the contract; Such spare parts that the Purchaser may be able to purchase from other supplier/manufacturers but are compatible with the goods procured]*
ITT 29.3(b)	Manufacturer's authorization is: Manufacturer's Authorization (Form PG5A-5) is required for all item mentioned in Guaranteed Technical Particular (GTP), Section 8. Note: Authorization letter from Manufacturer's Sales office (if located outside the manufacturing country) and Dealer/Trading house will not be accepted if not supported by Manufacturer's letter. In this regard, scanning paper, email copy, faxed copy & sealed signature will not be accepted. Manufacturer's signature in Authorization letter shall be hand written by pen i.e, signature through stamp/seal is not accepted. The Authorization letter shall contain manufacturer official's domain e-mail address, telephone/fax and designation with detail address of the manufacturer representative duly signed in the manufacturer's official pad.
ITT 29.3(c)	After sales service is required.
ITT 30.2	The Tender validity period shall be 240 days.
ITT 32.2	The amount of the Tender Security shall be **As per Tender Notice** in favour of Secretary, BPDB.
ITT 37.1	In addition to the original of the Tender, 3(three) copies shall be submitted within the date and time mentioned in the Tender Notice.
E. Submission of Tender	
ITT 38.2(e)	The inner and outer envelopes shall bear the following additional identification marks : 1. *Date of Submission* 2. *Seal & Signature of the Tenderer* Book Binding and Page Number is required for original and copies. **Any Technical offer associated with Financial offer in the same envelopes will be rejected.**
ITT 38.4(e)	The inner and outer envelopes shall bear the following additional identification marks : 1. *Date of Submission* 2. *Seal & Signature of the Tenderer.*
ITT 39.1	For **Tender submission purposes**, the Purchaser's address is: Attention: **Secretary, BPDB** Address: WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564350

	e-mail address: secretary@bpdb.gov.bd The deadline for submission of Tenders is: as specified in Tender Notice or subsequent amendment for Tender submission (if any). Electronic Tender submission is not permitted.
ITT 39.3	For **Tender submission purposes** only, the Procuring Entity's address is: Multiple Dropping is Not Applicable. Address **(PRIMARY PLACE):** Attention: **Secretary, BPDB** Address**:** WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564350 e-mail address: secretary@bpdb.gov.bd Address **(SECONDARY PLACES): Not Applicable.** The deadline for the submission of Tenders is: as specified in tender notice or amendment of submission time (if any).
ITT 39.4	The deadline for hand-delivering of the Tenders at the **PRIMARY PLACE** is: as specified in tender notice or amendment of submission time (if any).
F. Opening and Evaluation of Tenders	
ITT 45.1	The technical offer opening shall take place at (*always the **primary place***): **Office of the secretary, BPDB** Address: WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564765 e-mail address: secretary@bpdb.gov.bd Time & Date: as specified in Tender Notice or subsequent amendment for Tender submission (if any). The tender shall be opened in presence of the Tenderers. Electronic Tender opening procedures is not permitted.
ITT 57.5	The applicable economic factors, for the purposes of evaluation of Tenders shall be: (a) **Adjustment for Deviations in the Delivery and Completion Schedule: Not Applicable.** **"***The Plant and Service covered by this Tendering process are required to be delivered in accordance with, and completed within, the Delivery and Completion Schedule specified in Section 6, Employer's Requirements. No credit will be given for earlier completion. Tender offering delivery schedules beyond of the date specified in Section 6, Employer's Requirement, shall be rejected."* (b) **Cost of major replacement components, mandatory spare parts, and service: Not Applicable.** (c) **Other factors affecting the true economic value:** Applicable only for Capitalization cost of Power Transformer as per Technical Specification.

ITT57.7 **(New Clause)**	a) If the lowest Evaluated Tender is significantly below the official estimated cost or unbalanced as a result of front loading in the opinion of the TEC, the TEC may require the Tenderer to produce detailed breakdown of unit price or rates for any or all items of the Price Schedule, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the breakdown of the unit price or rates, taking into consideration the schedule of estimated Contract payments, the Purchaser may require that the amount of the Performance Security set forth in ITT Sub Clause 65.2 be increased at the expenses of the Tenderer to a level as stated in TDS under ITT Sub Clause 65.4 sufficient to protect the Employer against financial loss in the event of default by such Tenderer during Contract implementation, if awarded the Contract.
G. Award of Contract	
ITT 65.2	The amount of Performance Security shall be *Ten percent 10%* of the Contract Price for the Facility or for the part of the Facility for which a separate Time for Completion is provided.
ITT65.4 **(New Clause)**	The Employer may increase the amount of the Performance Security above the amounts as stated under ITT Sub Clause 65.2 but not exceeding twenty five (25) percent of the Contract price, if it is found that the Tender is significantly below the official estimated cost or unbalanced as a result of front loading as stated under ITT Sub Clause 57.7
ITT 72.5	The name and address of the office where complaints to the Purchaser are to be submitted is: Attention: **Secretary, BPDB** Address: WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564765 e-mail address: secretary@bpdb.gov.bd

Section 3.General Conditions of Contract

A. General

1. Definitions

1.1 In the Conditions of Contract, which include Particular Conditions and these General Conditions, the following words and expressions shall have the meaning hereby assigned to them. Boldface type is used to identify the defined terms:

(a) **Approving Authority** means the authority which, in accordance with the Delegation of Financial powers, approves the award of Contract for the Procurement of Goods, Works and Services.

(b) **Act means** The Public Procurement Act, 2006 (Act 24 of 2006).

(c) **Commissioning** means operation of the Facilities or any part thereof by the Contractor following Completion, which operation is to be carried out by the Contractor for the purpose of carrying out Guarantee Test(s).

(d) **Competent Authority** means the authority that gives decision on specific issues as per delegation of administrative and/or financial powers.

(e) **Completion** means that the Facilities (or a specific part thereof where specific parts are specified in the Contract) have been completed operationally and structurally and put in a tight and clean condition, that all work in respect of Pre Commissioning of the Facilities or such specific part thereof has been completed, and that the Facilities or specific part thereof are ready for Commissioning.

(f) **Completion Certificate** means the Certificate issued by the Project Manager as evidence that the Contractor has executed the services in all respects as per design, drawing, specifications and Conditions of Contract.

(g) **Completion Date** is the actual date of completion of the plant and services certified by the Project Manager, in accordance with GCC Clause 24.

(h) **Contract Agreement** means the Agreement entered into between the Procuring Entity and the Contractor, together with the Contract Documents referred to therein, including all attachments, appendices, and all documents incorporated by reference therein to supply and install Plant & Equipment

(i) **Contract Documents** means the documents listed in GCC Clause 6, including any amendments thereto.

(j) **Contractor/supplier** means the Person under contract with the Procuring Entity for the supply and installation of Plant & Equipment under the Rules and the Act as stated in the **PCC**.

(k) **Contractor's Representative** means any person nominated by the Contractor and approved by the

Employer to perform the duties delegated by the Contractor.

(l) **Contract Price** means the price payable to the Contractor as specified in the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, for the supply and installation of plant & equipment in accordance with the provisions of the Contract, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

(m) **Cost** means all expenditures reasonably incurred or to be incurred by the Contractor, whether on or off the Site, including overhead ,profit, taxes, duties, fees, and such other similar levies

(n) **Day** means calendar day unless otherwise specified as working days.

(o) **Dayworks** means work carried out following the instructions of the Procuring Entity or the authorised Project Manager and is paid for on the basis of time spent by the Contractor's workers and equipment at the rates specified in the Schedules, in addition to payments for associated Materials and Plant.

(p) **Defect** is any part of the Works not completed in accordance with the Contract.

(q) **Defect Liability Period** means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in contract document.

(r) **Defects Correction Certificate** is the certificate issued by the Project Manager upon correction of defects by the Contractor.

(s) **Drawings** include calculations and other information provided in Section 7 or as approved by the Project Manager for the execution and completion of the Contract.

(t) **Effective Date** means the date of fulfillment of all conditions of the Contract Agreement, from which the Time for Completion shall be counted.

(u) **Equipment**means all facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Facilities.

(v) **Facilities** means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract. It also includes any ancillary building or infra structure that needs to be constructed/built/erected to support the plant.

(w) **Force Majeure** means an event or situation beyond the control of the Contractor that is not foreseeable, is

unavoidable, and its origins not due to negligence or lack of care on the part of the Contractor; such events may include, but not be limited to, acts of the Government in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes or more as included in GCC Clause 52.

(x) **Goods** mean the Contractor's Plant, Equipment, Materials or any of them as appropriate.

(y) **GCC** means the General Conditions of Contract.

(z) **Government** means the Government of the People's Republic of Bangladesh.

(aa) **Guarantee Test(s)**means the test(s) specified in the Employer's Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, in accordance with the provisions of GCC Sub-Clause 43 (Guarantee Test) hereof.

(bb) **Head of the Procuring Entity** means the Secretary of a Ministry or a Division, the Head of a Government Department or Directorate; or the Chief Executive, by whatever designation called, of a local Government agency, an autonomous or semi-autonomous body or a corporation, or a corporate body established under the Companies Act;

(cc) **Installation Services** means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc. as the case may require.

(dd) **Intended Completion Date** is the date calculated from the Commencement Date as specified in the PC**C**, on which it is intended that the Contractor shall complete the Works and Physical services as specified in the Contract and may be revised only by the Project Manager by issuing an extension of time or an acceleration order.

(ee) **Materials** means things of all kinds other than Plant intended to form or forming part of the Permanent Works, including the supply-only materials, if any, to be supplied by the Contractor under the Contract.

(ff) **Month** means calendar month.

(gg) **Original Contract Price** is the Contract Price stated in the Procuring Entity's Notification of Award (Form PG5A-7) and further clearly determined in the **PCC**.

(hh) **Operational Acceptance** means the acceptance by the Employer of the Facilities (or any part of the Facilities

where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of contract

(ii) **PCC** means the Particular Conditions of Contract.

(jj) **Plant** means permanent plant, equipment, machinery, apparatus, materials, articles, ancillary buildings/structure and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor), but does not include Contractor's Equipment.

(kk) **Pre Commissioning** means the testing, checking and other requirements specified in the Employer's Requirements that are to be carried out by the Contractor in preparation for Commissioning.

(ll) **Procuring Entity/Employer/Purchaser** means, as the context so applies, an Entity having administrative and financial powers to undertake procurement of Plant and Physical services using public funds and is as named in the **PCC** who employs the Contractor to carry out the contractual obligations.

(mm) **Project Manager** is the person named in the **PCC** or any other competent person appointed by the Procuring Entity and notified to the Contractor who is responsible for supervising the execution and completion of the plant and services and administering the Contract.

(nn) **Schedules** means the document(s) entitled schedules, completed by the Contractor and submitted with the Tender Submission Letter, as included in the Contract. Such document may include the data, lists and schedules of rates and/or prices.

(oo) **Site** means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the PC**C** as forming part of the Site

(pp) **Site Investigation Reports** are those that were included in the Tender Document and are factual and interpretative reports about the surface and subsurface conditions at the Site.

(qq) **Specification** means the Specification of the goods/works/related services included in the Contract and any modifications or additions to the specifications made or approved by the Project Manager in accordance with the Contract.

(rr) **Start Date** is the date defined in the **PCC** and it is the last date when the Contractor shall commence execution of the goods/works/services under the Contract.

(ss) **Subcontractor** means a person or corporate body, who has a contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.

(tt) **Time for Completion** means the time within which

Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, in accordance with the relevant provisions of the Contract.

(uu) **Variation** means any change to the plant and services directly procured from the original Contractor to cover increases or decreases in quantities, including the introduction of new work items that are either due to change of plans, design or alignment to suit actual field conditions, within the general scope and physical boundaries of the contract.

(vv) **Works** means all works associated with the construction, reconstruction, site preparation, demolition, repair, maintenance or renovation of railways, roads, highways, or a building, an infrastructure or structure or an installation or any construction work relating to excavation, installation of equipment and materials, decoration, as well as physical services ancillary to works as detailed in the **PCC**, if the value of those services does not exceed that of the Works themselves.

(ww) Writing means communication written by hand or machine duly signed and includes properly authenticated messages by facsimile or electronic mail.

2. Interpretation

2.1 In interpreting the GCC, singular also means plural, male also means female or neuter, and the other way around. Headings in the GCC shall not be deemed part thereof or be taken into consideration in the interpretation or construance of the Contract. Words have their normal meaning under the language of the Contract unless specifically defined.

2.2 Entire Agreement.

The Contract constitutes the entire agreement between the Employer and the Contractor and supersedes all communications, negotiations and agreements (whether written or verbal) of parties with respect thereto made prior to the date of Contract Agreement; except those stated under GCC Sub Clause 6.1(j).

2.3 Non waiver.

(a) Subject to GCC Sub Clause 2.3(b), 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.

2.4. 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.

2.5. Sectional completion

If sectional completion is specified in the **PCC**, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

3. Communications & Notices

3.1 Communications between Parties such as notice, request or consent required or permitted to be given or made by one party to the other pursuant to the Contract shall be in writing to the addresses specified in the **PCC.**

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

3.3 A Party may change its address for notice hereunder by giving the other Party notice of such change to the address.

4. Governing Law

4.1 The Contract shall be governed by and interpreted in accordance with the laws of the People's Republic of Bangladesh.

5. Governing Language

5.1 The Contract shall be written in English. All correspondences and documents relating to the Contract may be written in English. 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 English, in which case, for purposes of interpretation of the Contract, such translation shall govern.

5.2 The Contractor shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.

6. Documents Forming the Contract and Priority of Documents

6.1 The following documents forming the Contract shall be interpreted in the following order of priority:

(a) the signed Contract Agreement (**Form PG5A-8**);

(b) the Notification of Award (**PG5A-7**);

(c) the completed Tender and the **Appendix to the Tender**;

(d) the Price Schedule for Plant and Services **(PG5A-3);**

(e) the Particular Conditions of Contract;

(f) the General Conditions of Contract;

(g) the Technical Specifications;

(h) Personnel Information;

(i) Equipment Information;

(j) the Drawings; and

(k) Any other document listed in the PCC forming part of the

Contract.

7. Contract Agreement

7.1 The parties shall enter into a Contract Agreement within twenty eight (28) days from the date of issuance of the Notification of Award (NOA). The costs of stamp duties and similar charges, if any, designated by the applicable law in connection with entry into the Contract Agreement, shall be borne by the Employer.

8. Assignment

8.1 Neither the Contractor nor the Employer shall assign, in whole or in part, its obligations under the Contract; except with the Employer's prior written approval.

9. Eligibility

9.1 The Contractor and its Subcontractor(s) shall have the nationality of a country other than that specified in the PCC.

9.2 All materials, equipment, plant, and supplies used by the Contractor in both permanent and temporary works and services supplied under the Contract shall have their origin in the countries except any specified in the PCC.

10. Gratuities / Agency fees

10.1 No fees, gratuities, rebates, gifts, commissions or other payments, other than those included in the Contract, shall be given or received in connection with the procurement process or in the Contract execution.

11. Confidential Details

11.1 The Employer and the Contractor 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 Contractor may furnish to its Subcontractor such documents, data, and other information it receives from the Employer to the extent required for the Subcontractor to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor an undertaking of confidentiality similar to that imposed on the Contractor under GCC Clause 11.

11.2 The Employer shall not use such documents, data, and other information received from the Contractor for any purposes unrelated to the Contract. Similarly, the Contractor shall not use such documents, data, and other information received from the Employer for any purpose other than the design, construction, or other work and services required for the performance of the Contract.

11.3 The obligations of a party under GCC Sub Clauses 11.1 and 11.2 above, however, shall not apply to information that: the Employer or Contractor needs to share with institutions participating in the financing of the Contract; now or hereafter enters the public domain through no fault of that party; 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 otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.

11.4 The above provisions of GCC Clause 11 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 Works or any part thereof.

11.5 The provisions of GCC Clause 11 shall survive completion or termination, for whatever reason.

12. Joint Venture (JV)

12.1 If the Contractor is a Joint Venture, Consortium, or Association (JVCA),

(a) each partner of the JV shall be jointly and severally liable for all liabilities and ethical or legal obligations to the Employer for the performance of the Contract;

(b) the JV partners shall nominate a representative who shall have the authority to conduct all business including the receipt of payments for and on behalf of all partners of the JV;

(c) in the event of a dispute that results in legal action against all partners of the JV, if they are available and if only one partner is available, then that partner alone shall answer on behalf of all partners and, if the complaint lodged is proven, the penalty shall be applicable on that lone partner as whatever penalty all the partners would have received.

(d) the JV shall notify the Employer of its composition and legal status which shall not be altered without the prior approval of the Employer.

(e) alteration of partners shall only be allowed if any of the partners is found to be incompetent or has any serious difficulties which may impact the overall implementation of the goods/works/service, whereby the incoming partner shall require to possess qualifications equal to or higher than that of the outgoing partner.

(f) if any of the partners of JV has been debarred from participating in any procurement activity due to corrupt, fraudulent, collusive or coercive practices, that JV partner shall be altered following provisions under GCC Sub Clause 12.1 (d) and (e), while in case the Leading Partner has been debarred due to the same reasons stated herein the Contract shall be terminated as stated under GCC Sub Clause 67.1(b).

13. Possession of the Site

13.1 The Employer shall give possession of the Site or part(s) of the Site, to the Contractor on the date(s) stated in the PCC. If possession of a part of the Site is not given by the date stated in the PCC, the Employer will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event.

14. Access to the Site

14.1 The Contractor shall allow the Engineer and any person authorised by the Engineer access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

15. Safety, Security and Protection of

15.1 The Contractor shall throughout the execution and completion of the Works and the remedying of any defects therein:

the Environment

(a) take all reasonable steps to safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state;

(b) provide and maintain at the Contractor's own cost all lights, guards, fencing, warning signs and watching for the protection of the Works or for the safety on-site; and

(c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.

16. Working Hours

16.1 The Contractor shall not perform any work on the Site on the weekly holidays, or during the night or outside the normal working hours, or on any religious or public holiday, without the prior written approval of the Project Manager.

17. Welfare of Laborers

17.1 The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's personnel relating to their employment, health, safety, welfare, immigration and shall allow them all their legal rights.

17.2 The Contractor, in particular, shall provide proper accommodation to his or her labourers and arrange proper water supply, conservancy and sanitation arrangements at the site for all necessary hygienic requirements and for the prevention of epidemics in accordance with relevant regulations, rules and orders of the government.

17.3 The Contractor, further in particular, shall pay reasonable wages to his or her labourers, and pay them in time. In the event of delay in payment the Employer may effect payments to the labourers and recover the cost from the Contractor.

17.4 The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take appropriate protective measures to prevent accidents that could result in injury. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

18. Child Labor

18.1 The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, 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 in compliance with the applicable laws and other relevant treaties ratified by the government.

19. Fossils& antiquities

19.1 All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

19.2 The Contractor shall, upon discovery of any such finding, promptly give notice to the Project Manager, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs cost from complying with the instructions, the Contractor shall give a further notice to the Project Manager and shall be entitled subject to Claims under GCC Clause 71

20. Corrupt, Fraudulent, Collusive or Coercive Practices

20.1 The Government requires that Employer, as well as the Contractor shall observe the highest standard of ethics during the implementation of procurement proceedings and the execution of the Contract.

20.2 The Government requires that Employer, as well as the Contractor shall, during the Procurement proceedings and the execution of the Contract under public funds, ensure-

(a) strict compliance with the provisions of Section 64 of the Public Procurement Act, 2006

(b) abiding by the code of ethics as mentioned in the Rule127 of the Public Procurement Rules, 2008;

(c) that neither it, nor any other member of its staff, or any other agents or intermediaries working on its behalf engages in any such practice as detailed in GCC Sub Clause 20.2.

20.3 For the purposes of GCC Sub Clause 20.2, the terms set forth below as follows

(a) "**corrupt practice**" means offering, giving or promising to give, receiving, or soliciting either directly or indirectly, to any officer or employee of a Employer or other public or private authority or individual, a gratuity in any form; employment or any other thing or service of value as an inducement with respect to an act or decision or method followed by a Employer in connection with a Procurement proceeding or Contract execution;

(b) **"fraudulent practice"** means the misrepresentation or omission of facts in order to influence a decision to be taken in a Procurement proceeding or Contract execution;

(c) **collusive practice**" means a scheme or arrangement between two (2) or more Persons, with or without the knowledge of the Employer, that is designed to arbitrarily reduce the number of Tenders submitted or fix Tender prices at artificial, non-competitive levels, thereby denying a Employer the benefits of competitive price arising from genuine and open competition; or

(d) "**Coercive practice**" means harming or threatening to harm, directly or indirectly, Persons or their property to influence a decision to be taken in the Procurement proceeding or the execution of the Contract, and this will include creating obstructions in the normal submission process used for Tenders.

20.4 Should any corrupt, fraudulent, collusive or coercive practice of any kind come to the knowledge of the Employer, it will, in the first place, allow the Contractor to provide an explanation and

shall, take actions only when a satisfactory explanation is not received. Such decision and the reasons thereof, shall be recorded in the record of the procurement proceedings and promptly communicated to the Contractor. Any communications between the Contractor and the Employer related to matters of alleged fraud or corruption shall be in writing.

20.5 If corrupt, fraudulent, collusive or coercive practices of any kind determined by the Employer against the Contractor alleged to have carried out such practices, the Employer will :

(a) exclude the Contractor from further participation in the particular Procurement proceeding; or

(b) declare, at its discretion, the Contractor to be ineligible to participate in further Procurement proceedings, either indefinitely or for a specific period of time.

20.6 20.6 The Contractor shall be aware of the provisions on corruption, fraudulence, collusion and coercion in Section 64 of the Public Procurement Act, 2006 and Rule 127 of the Public Procurement Rules, 2008.

21. License/ Use of Technical Information

21.1 For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and non-transferable license (without the right to sub-license) to the Employer under the patents, utility models or other industrial property rights owned by the Contractor or by a third Party from whom the Contractor has received the right to grant licenses thereunder, and shall also grant to the Employer a non-exclusive and non-transferable right (without the right to sub-license) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how or other intellectual property right from the Contractor or any third Party to the Employer.

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

B. Subject Matter of Contract

22. Scope of Facilities

22.1 Unless otherwise expressly limited in the Employer's Requirements, the Contractor's obligations cover the provision of all Plant and the performance of all Installation Services required for the design, and the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Pre Commissioning and delivery) of the Plant, and the installation, completion and commissioning of the Facilities in accordance with the plans, procedures, specifications, drawings, codes and any other documents as specified in the Section, Employer's Requirements. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labor, materials, equipment, spare parts and accessories; Contractor's Equipment; construction utilities and supplies; temporary

materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works and services that will be provided or performed by the Employer, as set forth in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer.

22.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.

22.3 In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities for the period **specified in the PCC** and the provisions, if any, **specified in the PCC.** However, the identity, specifications and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in **Price Schedule No.1 & 2 under form PG5A-3**, which shall be added to the Contract Price. The price of such spare parts shall include the purchase price therefor and other costs and expenses (including the Contractor's fees) relating to the supply of spare parts.

23. Time for Commencement

23.1 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time **stated in the PCC** or within such extended time to which the Contractor shall be entitled under GCC Clause 65.1 hereof.

24. Time for Completion

24.1 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time **stated in the PCC**or within such extended time to which the Contractor shall be entitled under GCC Clause 65.1 hereof.

25. Employer's Responsibilities

25.1 All information and/or data to be supplied by the Employer as described in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, shall be deemed to be accurate, except when the Employer expressly states otherwise

25.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix.

25.3 The Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where

the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer).

25.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain

25.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Pre Commissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, at or before the time specified in the program furnished by the Contractor under the provisions of contract specified or as otherwise agreed upon by the Employer and the Contractor.

25.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Sub-Clause 39.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Sub-Clause 40.2.

25.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 25 shall be the responsibility of the Employer, save those to be incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Sub-Clause 40.2.

25.8 In the event that the Employer shall be in breach of any of his obligations under this Clause, the additional cost incurred by the Contractor in consequence thereof shall be determined by the Project Manager and added to the Contract Price

26. Contractor's Responsibilities

26.1 The Contractor shall design, manufacture including associated purchases and/or subcontracting, install and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.

26.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date twenty-eight (28) days prior

to tender submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.

26.3 The Contractor shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 25.3 hereof and that are necessary for the performance of the Contract.

27. Employer's and Contractor's Risks

27.1 The Employer carries the risks that the Contract states are Employer's risks and the Contractor carries the risks that the Contract states are Contractor's risks.

28. Employer's Risks

28.1 From the Start Date until the Defects Correction Certificate has been issued, the following are Employer's risks:

(a) the risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to

i. use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or

ii. negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or Contracted to him except the Contractor.

iii. the risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.

28.2 From the Completion Date until the Defects Correction Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is Employer's risk, except loss or damage due to:

(a) a Defect which existed on the Completion Date;

(b) an event occurring before the Completion Date, which was not itself Employer's risk; or

(c) the activities of the Contractor on the Site after the Completion Date.

29. Contractor's Risks

29.1 From the Start Date until the Defects Correction Certificate has been issued the risks of personal injury, death, and loss of or damage to property including without limitation, the Works, Plant, Materials, and Equipment, which are not Employer's risks are Contractor's risks.

C. Execution of the Facilities

30. Representatives

31.1 Project Manager

If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided.

All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided.

30.2 Contractor's Representative & Construction Manager

30.2.1 If the Contractor's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within fourteen (14) days giving the reason therefor, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 30.2.1 shall apply thereto.

30.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 30.2.1.

30.2.3 . The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers,

functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager.

Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 30.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.

30.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as the Construction Manager's deputy.

30.2.5 The Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Sub-Clause 37.4. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

30.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 30.2.5, the Contractor shall, where required, promptly appoint a replacement.

31. Work Program

31.1 Contractor's Organization

The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.

31.2 Program of Performance

Within twenty-eight (28) days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and Pre Commission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix

to the Contract Agreement titled Time Schedule, and any other dates and periods specified in the Contract.

The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion specified in the PCC pursuant to Sub-Clause 24.1 and any extension granted in accordance with GCC Clause 65.1, and shall submit all such revisions to the Project Manager.

31.3 **Progress Report**

The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 31.2 above, and supply a progress report to the Project Manager every month.

The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.

31.4 **Progress of Performance**

If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 31.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 24.1, any extension thereof entitled under GCC Sub-Clause 65.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

31.5 **Procedures**

The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements. The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

32. Subcontractor

32.1 Subcontracting the whole of the Plant and Service by the Contractor shall not be permissible. The Contractor shall be responsible for the acts or defaults of any Subcontractor, his or her agents or employees, as if they were the acts or defaults of the Contractor.

32.2 The Contractor shall not be required to obtain consent from the Project Manager or his representative, for suppliers solely of Materials or to a subcontract for which the Specialist Subcontractor(s) is already named in the Contract.

32.4 The prior consent, in writing, of the Engineer shall however be obtained for other proposed Subcontractor(s).

33. Nominated Subcontractor

33.1 Nominated Subcontractor named in the Contract shall be entitled to execute the specific components of the Works stated in the **PCC.**

33.2 The Contractor shall not be under obligations to employ a Nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars while there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength, or does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, or does not accept to enter into a subcontract which specifies that, for the subcontracted work including design, if any, the Nominated Subcontractor shall undertake to the Contractor such obligations and liabilities as will enable the contractor to discharge his or her liabilities under the Contract.

34. Other Contractors

34.1 The Contractor shall cooperate and share the Site with other Contractors, public authorities, utilities, the Engineer and the Employer between the dates given in the Schedule of other Contractors. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of other Contractors, and shall notify the Contractor of any such modification.

35. Design and Engineering

35.1 **Specifications and Drawings**

35.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice. The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.

35.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager.

35.2 **Codes and Standards**

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of tender submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 64.

35.3. **Approval/Review of Technical Documents by Project Manager**

35.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix to the Contract Agreement titled List of Documents for Approval or Review, for its approval or review as specified and in accordance with the requirements of GCC Sub-Clause 31.2 (Program of Performance).

Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.

GCC Sub-Clauses 35.3.2 through 35.3.6 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only

35.3.2 Within fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 35.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes. If the Project Manager fails to take such action within the said fourteen (14) days, then the said document shall be deemed to have been approved by the Project Manager.

35.3.3. The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice.

35.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub-Clause 35.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved.

35.3.5 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.

35.3.6 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manageran amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Sub-Clause 35.3. If the Project Manager requests any change in any already approved

document and/or in any document based thereon, the provisions of GCC Clause 64 shall apply to such request.

36. Procurement

36.1 **Plant**

Subject to GCC Sub-Clause 60.2, the Contractor shall procure and transport all Plant in an expeditious and orderly manner to the Site.

36.2 **Employer-Supplied Plant**

If the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply:

36.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the Parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Sub-Clause 31.2, unless otherwise mutually agreed.

36.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect or default. The Employer shall immediately remedy any shortage, defect or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody and control of the Contractor. The provision of this GCC Sub-Clause 36.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired.

36.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody and control shall not relieve the Employer of liability for any undetected shortage, defect or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 42 or under any other provision of Contract.

36.3 **Transportation**

36.3.1 The Contractor shall at its own risk and expense transport all the materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances.

36.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment.

36.3.3 Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the Parties.

36.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site.

36.4 **Customs Clearance**

The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Sub-Clause 60.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 65.

37. Installation

37.1 **Setting Out/Supervision**

37.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks and lines provided to it in writing by or on behalf of the Employer.

If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer.

37.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

37.2 Labor:

37.2.1 Engagement of Staff and Labor

(a) Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, housing, feeding and transport.

(b) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.

(c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel.

(d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.

37.2.2 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst the Employer's Personnel.

37.2.3 Facilities for Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works

37.3 **Contractor's Equipment**

37.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.

37.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto

the Site and any surplus materials remaining thereon.

37.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.

37.4 **Site Regulations and Safety**

The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld.

Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention. reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.

37.5 **Site Clearance**

37.5.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract

37.6 **Opportunities for Other Contractors**

37.6.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site.

37.6.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Contractor reasonable remuneration for the use of such equipment or the provision of such services.

37.7 **Emergency Work**

37.7.1 If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Contractor shall immediately carry

out such work.

If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract.

37.7.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition.

37.8 **Watching and Lighting**

The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.

38. Test & Inspection

38.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.

38.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.

38.3 38.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third Party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.

38.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection. If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the Parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

38.5 38.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor'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 impede the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.

38.6 If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 38.3.

38.7 If any dispute or difference of opinion shall arise between the Parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the Parties within a reasonable period of time, it may be referred to an 72.2.

38.8 The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.

38.9 The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 38.4, shall release the Contractor from any other responsibilities under the Contract.

38.10 39.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.

38.11 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.

38.12 If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 38.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.

39. Completion of the Facilities

39.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

39.2 Within seven (7) days after receipt of the notice from the Contractor under GCC Sub-Clause 39.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer for Pre Commissioning of the Facilities or any part thereof.

Pursuant to the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, the Employer shall also provide, within the said seven (7) day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Pre Commissioning of the Facilities or any part thereof.

39.3 As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters have been provided by the Employer in accordance with GCC Sub-Clause 39.2, the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Sub-Clause 40.5.

39.4 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or

any part thereof is ready for commissioning, the contractor shall so notify the Project Manager in writing.

39.5 The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 39.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Sub-Clause 39.4, or notify the Contractor in writing of any defects and/or deficiencies.

If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 39.4.

39.6 If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's repeated notice.

39.7 If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

39.8 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 39.4 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 39.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.

39.9 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

39.10 Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall

thereafter take over the Facilities or the relevant part thereof.

40. Commissioning and Operational Acceptance

40.1 **Commissioning**

40.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Sub-Clause 39.5, or immediately after the date of the deemed Completion, under GCC Sub-Clause 39.6.

40.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning.

40.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.

40.2 **Guarantee Test**

40.2.1 Subject to GCC Sub-Clause 40.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test and any repeats thereof.

40.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion **specified in the PCC** or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Sub-Clauses 43.2 and 43.3 shall not apply.

40.3 **Operational Acceptance**

40.3.2 At any time after any of the events set out in GCC Sub-Clause 40.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's Requirements (Forms and Procedures)in respect of the Facilities or the part thereof specified in such notice as of the date of such notice.

40.3.3 The Project Manager shall, after consultation with the Employer, and within seven (7) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

40.3.4 If within seven (7) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.

40.4 **Partial Acceptance**

40.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities.

40.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate

40.5 **Delayed Pre-commissioning and/or Guarantee Test**

40.5.1 In the event that the Contractor is unable to proceed with the Pre-commissioning of the Facilities pursuant to Sub-Clause 39.3, or with the Guarantee Test pursuant to Sub-Clause 40.2, for reasons attributable to the Employer either on account of non-availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Contractor's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Sub-Clause 39.6, and Operational Acceptance, pursuant to GCC Sub-Clause 40.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Sub-Clause 42.2, Functional Guarantee, pursuant to GCC Clause 43, and Care of Facilities, pursuant to GCC Clause 48, and GCC Clause 66.1, Suspension, shall not apply. In this case, the following provisions shall apply.

40.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to clauses 58 & 59, the Contractor shall be entitled to the following:

(a) the Time of Completion shall be extended for the period of suspension without imposition of liquidated damages pursuant to GCC Sub-Clause 41.2;

(b) payments due to the Contractor in accordance with the provision specified in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which would not have been payable in normal circumstances due to non-completion of the subject activities, shall be released to the Contractor against submission of a security in the form of a bank guarantee of equivalent amount acceptable to the Employer, and which shall become null and void when the Contractor will have complied with its obligations regarding those payments, subject to the provision of Sub-Clause 40.5.3 below;

(c) the expenses towards the above security and extension of other securities under the contract, of which validity needs to be extended, shall be reimbursed to the Contractor by the Employer;

(d) the additional charges towards the care of the Facilities pursuant to GCC Sub-Clause 48.1 shall be reimbursed to the Contractor by the Employer for the period between the notification mentioned above and the notification mentioned in Sub-Clause 40.5.4 below. The provision of GCC Sub-Clause 49.2 shall apply to the Facilities during the same period.

40.5.3 In the event that the period of suspension under above Sub-Clause 40.5.1 actually exceeds one hundred eighty (180) days, the Employer and Contractor shall mutually agree to any additional compensation payable to the Contractor.

40.5.4 When the Contractor is notified by the Project Manager that the plant is ready for Pre-commissioning, the Contractor shall proceed without delay in performing Pre-commissioning, in accordance with Clause 39.

D. Guarantees and Liabilities

41. Completion Time Guarantee

41.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified) within the Time for Completion specified in the PCC pursuant to GCC Sub-Clause 24.1, or within such extended time to which the Contractor shall be entitled under GCC Clause 65 hereof

41.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 65, the Contractor shall pay to the Employer liquidated damages in the amount specified in the PCC as a percentage rate of the Contract Price or the relevant part thereof. The aggregate amount of such liquidated damages shall in no event exceed the amount specified as “Maximum” in the PCC as a percentage rate of the Contract Price. Once the “Maximum” is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 67.1.

Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 65. The Contractor shall have no further liability whatsoever to the Employer in respect thereof.

However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.

Save for liquidated damages payable under this GCC Sub-Clause 41.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix to the Contract Agreement titled Time Schedule, and/or other program of work prepared pursuant to GCC Sub-Clause 31.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.

41.3 If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 65, the Employer shall pay to the Contractor a bonus in the amount **specified in the PCC.** The aggregate amount of such bonus shall in no event exceed the amount **specified as "Maximum" in the PCC.**

42. Defect Liability

42.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant supplied and of the work executed.

42.2 The Defect Liability Period shall be five hundred and forty (540) days from the date of Completion of the Facilities (or any part thereof) or one year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the PCC pursuant to GCC Sub-Clause 42.10.

If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:

(a) improper operation or maintenance of the Facilities by the Employer;

(b) operation of the Facilities outside specifications provided in the Contract; or

(c) Normal wear and tear.

42.3 The Contractor's obligations under this GCC Clause 42 shall not apply to:

(a) any materials that are supplied by the Employer under GCC

Sub-Clause 36.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;

(b) any designs, specifications or other data designed, supplied or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or

(c) Any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Sub-Clause 42.7.

42.4 The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.

42.5 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 42.

The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

42.6 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.

42.7 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due the Contractor or claimed under the Performance Security.

42.8 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons.

42.9 Except as provided in GCC Clauses 42 and 49, the Contractor

shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, or criminal or willful action of the Contractor.

42.10 In addition, any such component of the Facilities, and during the period of time as may be **specified in the PCC,** shall be subject to an extended defect liability period. Such obligation of the Contractor shall be in addition to the defect liability period specified under GCC Sub-Clause 42.2.

43. Functional Guarantees

43.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, subject to and upon the conditions therein specified.

43.2 If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 67.1.

43.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either

(a) make such changes, modifications and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or

(b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix to the Contract Agreement titled Functional Guarantees.

43.4 The payment of liquidated damages under GCC Sub-Clause 43.3, up to the limitation of liability specified in the Appendix to the Contract Agreement titled Functional Guarantees, shall completely satisfy the Contractor's guarantees under GCC Sub-Clause 43.3, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance

Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.

44. Patent Indemnity

44.1 The Contractor shall, subject to the Employer's compliance with GCC Sub-Clause 44.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer 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 Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.

Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement.

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

If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

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

44.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor 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 Employer.

45. Limitation of Liability

45.1 Except in cases of criminal negligence or willful misconduct,

(a) neither Party shall be liable to the other Party, 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, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract, and

(b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the amount resulting from the application of the multiplier specified in the PCC, to the Contract Price or, if a multiplier is not so specified, 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 Contractor to indemnify the Employer with respect to patent infringement..

E. Risk Distribution

46. Transfer of Ownership

46.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant from the country of origin to that country.

46.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.

46.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.

46.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant in question are no longer required for the Facilities.

46.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.

47. Care of Facilities

47.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 39 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 42. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 48.2.

47.2 If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of

(a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or

(b) any use or occupation by the Employer or any third Party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or

(c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed responsibility herein,

47.3 the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 64. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 64, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub-Clause 66.1 hereof.

47.4 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Sub-Clause 42.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Sub-Clauses 47.2 (b) and (c).

48. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification

48.1 Subject to GCC Sub-Clause 48.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents.

48.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 48.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

48.3 If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

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

48.4 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 49, provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.

48.5 The Party entitled to the benefit of an indemnity under this GCC Clause 48 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.

49. Insurance

49.1 To the extent specified in the Appendix to the Contract Agreement titled Insurance Requirements, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.

(a) Cargo Insurance During Transport

Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the Contractor's Equipment.

(b) <u>Installation All Risks Insurance</u>

Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third Parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities.

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(g) Other Insurances

Such other insurances as may be specifically agreed upon by the Parties hereto as listed in the Appendix to the Contract Agreement titled Insurance Requirements.

49.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1 except for the Cargo Insurance during Transportation, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

49.3 The Contractor shall, in accordance with the provisions of the Appendix to the Contract Agreement titled Insurance Requirements, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.

49.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.

49.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix to the Contract Agreement titled Insurance Requirements, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insured under all such policies. All insurers' rights of

subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than twenty-one (21) days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Sub-Clause 49.5.

49.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 49.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due to the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 49.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein.

49.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies affected by it pursuant to this GCC Clause 49, and all monies payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

50. Unforeseen Conditions

50.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or

artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing beforehand:

(a the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen;
(b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions;
(c) the extent of the anticipated delay; and
(d) the additional cost and expense that the Contractor is likely to incur.)

On receiving any notice from the Contractor under this GCC Sub-Clause 50.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken.

50.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Sub-Clause 50.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price.

50.3 If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Sub-Clause 50.1, the Time for Completion shall be extended in accordance with GCC Clause 60.

51. Change in Laws and Regulation

51.1 Unless otherwise specified in the Contract, if after the Contract, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in Bangladesh (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.

52. Force Majeure

52.1 In this Clause, "Force Majeure" means an exceptional event or circumstance:

(a) which is beyond a Party's control;
(b) which such Party could not reasonably have provided against before entering into the Contract;
(c) which, having arisen, such Party could not reasonably have avoided or overcome; and
(d) which is not substantially attributable to the other Party.

52.2 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

(i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies;

(ii) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war;

(iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel;

(iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and

(v) natural catastrophes such as cyclone, hurricane, typhoon, tsunami, storm surge, floods, earthquake , landslides, fires, epidemics, quarantine restrictions, or volcanic activity;

(vi) freight embargoes;

(vii) acts of the Government in its sovereign capacity.

53. Notice of Force Majeure

53.1 If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure

53.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

53.3 Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

54. Duty to Minimize Delay

54.1 Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure.

54.2 A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

55. Consequences of Force Majeure

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

55.2 The Employer may suspend the delivery or contract implementation, wholly or partly, by written order for a certain period of time, as it deems necessary due to force majeure as defined in the contract.

55.3 Delivery made either upon the lifting or the expiration of the suspension order. However, if the Employer terminates the contract as stated under GCC clause 66, resumption of delivery cannot be done.

55.4 The Employer determines the existence of a force majeure that will be the basis of the issuance of suspension of order.

F. Payment

56. Contract Price

56.1 The Contract Price shall be paid as specified in the Contract Agreement Form **PG5A- 8.**

56.2 Unless an adjustment clause is **provided for in the PCC,** the Contract Price shall be a firm lump sum not subject to any alteration, except in the event of a Change in the Facilities or as otherwise provided in the Contract.

56.3 Subject to GCC Sub-Clauses 25.2, 26.1 and 50 hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.

56.4 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the PCC. If so provided, the amounts as certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amount. The generic formula indicated below in the form as specified in the PCC applies:

P= A + B (Im/Io)

where:

P is the adjustment factor

A and **B** are Coefficients specified in the PCC, representing the nonadjustable and adjustable portions, respectively, of the Contract; and

Im is the Index during the month the work has been executed and **Io** is the Index prevailing twenty eight (28) days prior to the deadline for submission of Tender.

The Indexes to be used is as published by the Bangladesh Bureau of Statistics (BBS) on a monthly basis. In case not available, then other countries or authorities of the sources mentioned in **Appendix to the Tender** may be used.

56.5 If the value of the Index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next or in the final payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.

57. Terms of Payment

57.1 The Contract Price shall be paid as specified in the Contract Agreement and **in the Appendix to the Contract Agreement titled Terms and Procedures of Payment**, which also outlines the procedures to be followed in making application for and processing payments.

57.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.

57.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendices to the Contract Agreement titled Terms and Procedures of Payment, for the period of delay until payment has been made in

full, whether before or after judgment or arbitrage award.

57.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendices to the Contract Agreement titled Terms and Procedures of Payment, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's tender.

58. Advance Payment Security

58.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix to the Contract Agreement titled Terms and Procedures of Payment, and in the same currency or currencies.

58.2 The security shall be in the form provided in the tender documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.

59. Performance Security

59.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security for the due performance of the Contract in the amount **specified in the PCC.**

59.2 The performance security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in the form provided in Section 5, Tender and Contract Forms, corresponding to the type of bank guarantee stipulated by the Employer in the PCC, or in another form acceptable to the Employer.

59.3 Unless otherwise specified in the PCC, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, five hundred and forty (540) days after Completion of the Facilities or three hundred and sixty five (365) days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 42.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 42.10, is liable for an extended defect liability obligation, the performance security shall be extended for the period specified in the PCC pursuant to GCC Sub-Clause 42.10 and up to the amount specified in the PCC.

59.4 The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract. The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

60. Taxes and Duties

60.1 The Contractor shall be entirely responsible for all kinds of taxes, duties, fees, levies, and such other charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.

60.2 Notwithstanding GCC Sub-Clause 60.1 above, the Employer shall bear and promptly pay

(a) all customs and import duties for the Plant specified in Price Schedule No. 1; and

(b) other domestic taxes such as, sales tax and value added tax (VAT) on the Plant specified in Price Schedules No. 1 and No. 2 and that is to be incorporated into the Facilities, and on the finished goods, imposed by the law of the country where the Site is located.

60.3 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.

61. Payments to Nominated Subcontractor(s)

61.1 The Contractor shall pay to the Nominated Subcontractor(s) the amounts shown on the Nominated Subcontractor's invoices approved by the Contractor in accordance with the subcontract included under the Contract.

62. Price Adjustment

62.1 Where the Contract Period (excluding the Defects Liability Period) exceeds eighteen (18) months, it is normal procedure that prices payable to the Contractor shall be subject to adjustment during the performance of the Contract to reflect changes occurring in the cost of labour and material components. In such cases the tender documents shall include in the Appendix 2, a formula of such price adjustment.

62.2 Where Contracts are of a shorter duration than eighteen (18) months or in cases where there is to be no Price Adjustment, the following provision shall not be included. Instead, it shall be indicated under this Appendix 2 that the prices are to remain firm and fixed for the duration of the Contract.

62.3 If the value of the Index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next or in the final payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.

63. Liquidated Damages

63.1 The Contractor shall be liable to pay Liquidated Damages or in other words the Delay Damages to the Employer at the rate per day as specified in the PCC for each day of delay from the Intended Completion Date, for the uncompleted delivery of goods/works/services or for any part thereof.

63.2 The total amount of Liquidated Damages shall not exceed the amount defined in the PCC.

63.3 Once the cumulative amount of Liquidated Damages reaches ten (**10**) percent of the Contract price, the Employer may rescind the Contract, without prejudice to other courses of action and remedies open to it.

63.4 The amount of Liquidated Damages may be deducted from any money due or which may become due to the Contractor under the Contract and/or collect such amount of Liquidated Damages from the Retention Money (if any) or other securities posted by the Contractor whichever is convenient to the Employer. In an extreme situation that no such foregoing recourse is available, the contractor be asked to make good the damages from his own finances in writing failing which necessary action as per the provisions of this GCC or PCC be taken.

63.5 Payment of Liquidated Damages by the Contractor shall not relieve the Contractor from its obligations.

63.6 If the Intended Completion Date is extended after Liquidated Damages have been paid, the Engineer shall correct any overpayment of Liquidated Damages by the Contractor by adjusting the next payment certificate.

G. Change in Contract Elements

64. Change in the Facilities

64.1 **Introducing a Change**

64.1.1 Subject to GCC Sub-Clauses 64.2.5 and 64.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Facilities hereinafter called “Change”, provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract

64.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer with a copy to the Project Manager, any Change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor, provided that the Employer shall approve any Change proposed by the Contractor to ensure the safety of the Facilities.

64.1.3 Notwithstanding GCC Sub-Clauses 64.1.1 and 64.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any

adjustment of the Contract Price or the Time for Completion.

64.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 64.2 and 64.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures).

64.2 **Changes Originating from Employer**

64.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 64.1.1, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a "Change Proposal," which shall include the following:

(a) brief description of the Change

(b) effect on the Time for Completion

(c) estimated cost of the Change

(d) effect on Functional Guarantees (if any)

(e) effect on the Facilities

(f) effect on any other provisions of the Contract.

64.2.2 Prior to preparing and submitting the "Change Proposal," the Contractor shall submit to the Project Manager an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal.

Upon receipt of the Contractor's Estimate for Change Proposal, the Employer shall do one of the following:

(a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal

(b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate

(c) advise the Contractor that the Employer does not intend to proceed with the Change.

64.2.3 Upon receipt of the Employer's instruction to proceed under GCC Sub-Clause 64.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Sub-Clause 64.2.1.

64.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change

.64.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 64 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen percent (15%), the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer shall withdraw the proposed Change and shall notify the Contractor in writing thereof.

The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

64.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision.

If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Sub-Clause 64.2.2.

64.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The Parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

64.3 **Changes Originating from Contractor**

64.3.1 If the Contractor proposes a Change pursuant to GCC Sub-Clause 64.1.2, the Contractor shall submit to the Project Manager a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Sub-Clause 64.2.1.
Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GCC Sub-Clauses 64.2.6 and

64.3.2. However, should the Employer choose not to proceed, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

65. Extension of Time for Completion

65.1 The Time(s) for Completion specified in the PCC pursuant to GCC Sub-Clause 8.2 shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

(a) any Change in the Facilities as provided in GCC Clause 64

(b) any occurrence of Force Majeure as provided in GCC Clause 52, unforeseen conditions as provided in GCC Clause 50, or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clause 47.2

(c) any suspension order given by the Employer under GCC Clause 41 hereof or reduction in the rate of progress pursuant to GCC Sub-Clause 66.2 or

(d) any changes in laws and regulations as provided in GCC Clause 51 or

(e) any default or breach of the Contract by the Employer, Appendix to the Contract Agreement titled ,or any activity, act or omission of the Employer, or the Project Manager, or any other contractors employed by the Employer, or

(f) any delay on the part of a sub-contractor, provided such delay is due to a cause for which the Contractor himself would have been entitled to an extension of time under this sub-clause, or

(g) delays attributable to the Employer or caused by customs, or

(h) any other matter specifically mentioned in the Contract

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

65.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

In all cases where the Contractor has given a notice of a claim for an extension of time under GCC 65.2, the Contractor shall consult with the Project Manager in order to determine the steps (if any) which can be taken to overcome or minimize the actual or anticipated delay. The Contractor shall there after comply with all reasonable instructions which the Project Manager shall give in order to minimize such delay. If compliance with such instructions shall cause the Contractor to incur extra costs and the Contractor is entitled to an extension of time under GCC 65.1, the amount of such extra costs shall be added to the Contract Price.

66. Suspension

66.1 The Employer may request the Project Manager, by notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons thereof. The Contractor shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Facilities, until ordered in writing to resume such performance by the Project Manager..

If, by virtue of a suspension order given by the Project Manager, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than ninety (90) days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within twenty-eight (28) days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 64, excluding the performance of the suspended obligations from the Contract.

If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 64 or, where it affects the whole of the Facilities, as termination of the Contract under GCC Sub-Clause 66.1.

66.2 **if**

(a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 57.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice or

(b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Sub-Clause 25.2, or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities,

then the Contractor may by fourteen (14) days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.

66.3 If the Contractor's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GCC Clause 66, then the Time for Completion shall be extended in accordance with GCC Sub-Clause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.

66.4 During the period of suspension, the Contractor shall not remove from the Site any Plant, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.

H. Termination and Settlement of Disputes

67. Termination

67.1 **Termination for Default**

(a) The Employer or the Contractor, without prejudice to any other remedy for breach of Contract, by giving twenty eight (28) days written notice of default to the other party, may terminate the Contract in whole or in part if the other party causes a fundamental breach of Contract.

(b) Fundamental breaches of the Contract shall include, but shall not be limited to, the following:

(i) the Contractor stops work for twenty-eight (28) days when no stoppage of work is shown on the current Programme and the stoppage has not been authorized

by the Engineer;

(ii) the Engineer instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within twenty-eight (28) days;

(iii) the Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;

(iv) the Engineer gives Notice that the failure to achieve the progress in accordance with the updated Programme of Works by the Contractor is a non-fulfilment of contractual obligations and the Contractor fails to restore it within a reasonable period of time instructed by the Engineer;

(v) the Contractor does not maintain a Security, which is required;

(vi) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of Liquidated Damages can be paid, as specified in GCC Sub Clause 41.2;

(vii) the Contractor has subcontracted the whole of the Works or has assigned the Contract without the required agreement and without the approval of the Engineer;

(viii) the Contractor, in the judgment of the Employer has engaged in practices, as defined in GCC Sub Clause 39, in competing for or in executing the Contract.

(c) A payment certified by the Engineer is not paid by the Employer to the Contractor within twenty eight (28) days of the date of the Engineer's certificate.

67.2 **Termination for Insolvency**

The Employer and the Contractor may at any time terminate the Contract by giving twenty eight (28) days written notice to the other party if either of the party becomes bankrupt or otherwise insolvent. In such event, termination will be without compensation to any party, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the other party.

67.3 **Termination for Convenience**

(a) The Employer, by giving twenty eight (28) days written notice sent to the Contractor, 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 Employer's convenience, the extent to which performance of the Contractor under the Contract is terminated, and the date upon which such termination becomes effective. The termination shall take effect twenty eight (28) days after the later dates on which the Contractor receives this notice or the Employer returns the Performance Security.

(b) The Employer shall not terminate the contract under GCC Sub Clause 67.1 (a) in order to execute the contract itself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor as stated under GCC Sub Clause 67.1(a).

67.4 In the event the Employer terminates the Contract in whole or in part, the Employer shall accept the portion of the Works that are complete and ready for handing over after the Contractor's receipt of notice of termination of the Contract. For the remaining portion of the Works, the Employer may elect:

(a) to have any portion completed by the Contractor at the Contract terms and prices; and /or

(b) to cancel the remainder and pay to the Contractor an agreed amount for partially completed Works and for materials and parts previously procured by the Contractor, or

(c) except in the case of termination for convenience as stated under GCC Sub Clause 67, engage another Contractor to complete the Works, and in that case the Contractor shall be liable to the Employer for any cost that may be incurred in excess of the sum that would have been paid to the Contractor, if the work would have been executed and completed by him or her.

67.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as is reasonably possible

68. Payment upon Termination

68.1 If the Contract is terminated because of a fundamental breach of Contract under GCC Sub Clause 67.1 by the Contractor, the Project Manager shall issue a certificate for the value of the Works done and Plant and Materials ordered less advance payments received up to the date of the issue of the certificate and less the amount from percentage to apply to the contract value of the works not completed, as indicated in the PCC. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.

68.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a payment certificate for the value of the work done, Materials ordered, the reasonable cost

of removal of Equipment, repatriation of the Contractor's foreign personnel employed solely on the Works and recruited specifically for the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

68.3 If the Contract is terminated for reasons of Force Majeure, the The Project Manager shall determine the value of the work done and issue a Payment Certificate which shall include.

(a) the amounts payable for any work carried out for which unit rates or prices are stated in the Contract;

(b) the cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;

(c) other costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;

(d) the cost of removal of Temporary Works and Contractor's Equipment from the Site; and

(e) the cost of repatriation of the Contractor's staff and labor employed wholly in connection with the Works at the date of termination.

69. Property

69.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default stated under GCC Sub Clause 67.1.

70. Frustration

70.1 If the Contract is frustrated by the occurrence of a situation of Force Majeure as defined in GCC Sub Clause 52, the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any work carried out afterwards to which a commitment was made.

I. Claims, Disputes and Arbitration

71. Contractor's Claims

71.1 If the Contractor considers himself to be entitled to any extension of the Completion Time and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Employer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than twenty eight (28) days after the Contractor became aware, or should have become aware, of the event or circumstance.

71.2 If the Contractor fails to give notice of a claim within such period of twenty eight (28) days, the Intended Completion Date shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim.

71.3 Within forty two (42) days after the Contractor became aware or should have become aware of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed, for settlement.

72. Settlement of Disputes

Amicable settlement

72.1 The Employer and the Contractor 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.

Arbitration

72.2 If, after twenty-eight (28) days, the parties have failed to resolve their dispute or difference by such mutual consultation as stated under GCC Clause 72.1, then either the Employer or the Contractor may give notice to the other party of its intention to commence arbitration in accordance with GCC Sub Clause 72.3, 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.

72.3 Arbitration shall be commenced prior to or after execution of the Works under the Contract. Arbitration proceedings shall be conducted in accordance with the rules of procedure specified in the PCC.

72.4 Notwithstanding any reference to arbitration hereinabove the parties shall continue to perform their respective responsibilities under the Contract unless agreed otherwise and, the Employer shall pay any monies due to the Contractor.

Section 4. Particular Conditions of Contract

Instructions for completing the Particular Conditions of Contract are provided in italics in parenthesis for the relevant GCC Clauses.	
GCC Clause	**Amendments of, and Supplements to, Clauses in the General Conditions of Contract**
GCC 1.1(j)	The Contractor is *[Name, address, and name of authorized representative]*
GCC 1.1 **(ll, mm)**	The Procuring Entity/Employer/Purchaser is Bangladesh Power Development Board (BPDB) **Representative:** Secretary Bangladesh Power Development Board (BPDB) Address: WAPDA Building (1st floor), Motijheel C/A, Dhaka-1000. Telephone: +880-2-9554209 Fax No.: +880-2-9564765 e-mail address: secretary@bpdb.gov.bd **Project Manager/Consignee:** Project Director, Power Distribution System Development, Chattogram Zone (2nd Phase), Bidduyut Bhaban (5th Floor), Agrabad BPDB, Chattogram. Camp Office: Bidduyut Bhaban (15th Floor),1 No. Abdul Goni Road, BPDB, Dhaka. E-mail: pd.pdsd2.cz@gmail.com Phone: +8801708168864, +8801708168866 **Engineer** "Engineer" Means Director, Directorate of Design & Inspection-II, 9/B, Motijheel C/A, Dhaka-1000. E-mail: dir.design2@bpdb.gov.bd, Phone: +880 2 955 0404, Fax: +880 2 955 0265. **"Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 05 Nos. New 33/11kV GIS Substation, 02 Nos. 33/11kV GIS Substation (Up-gradation), 02 Nos 33 kV Bay Extension & 33 kV XLPE 1x800 mm2 underground armoured copper cable (including optical fibre) Double Circuit line with Civil works, and other related works; including automation of the sub-station (SAS) interfacing with the existing SCADA System of Chattogram, on Turnkey Basis under Power Distribution System Development, Chattogram Zone (2nd Phase)"(LOT-3)** **Supplier:** Also means Contractor **Provisional Acceptance Certificate (PAC):** Also means Operational Acceptance Certificate (OAC).
GCC 1.1 **(t)**	**"Effective Date"** shall mean the date of establishing of Letter of Credit.
GCC 1.1 (dd)	The Intended Completion Date is 730 (Seven hundred and thirty) days calculated from the Effective date of Contract to acceptance of Commissioning and Guarantee test run.

<table>
<tr><td>GCC 1.1 (gg)</td><td>The Original Contract price is [insert the amount in the NOA]</td></tr>
<tr><td>GCC 1.1(oo)</td><td>The Site is located at different areas as follows under Power Distribution System Development Project, Chottogram Zone, BPDB:

<table>
<tr><td>01</td><td>33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.</td></tr>
<tr><td>02</td><td>33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram.</td></tr>
<tr><td>03</td><td>33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram.</td></tr>
<tr><td>04</td><td>33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.</td></tr>
<tr><td>05</td><td>33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.</td></tr>
<tr><td>06</td><td>33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.</td></tr>
<tr><td>07</td><td>Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram.</td></tr>
<tr><td>08</td><td>33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram.</td></tr>
<tr><td>09</td><td>33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram.</td></tr>
<tr><td>10</td><td>33 kV Underground Cable from Baklia Grid to Chokbazar 33/11 kV Substation BPDB, Chattogram.</td></tr>
<tr><td>11</td><td>33 kV Underground Cable from Baklia Grid to Korbanigonj 33/11 kV Substation BPDB, Chattogram.</td></tr>
<tr><td>12</td><td>33 kV Underground Cable from Khulshi Stadium Rising pole to Stadium 33/11 kV Substation BPDB, Chattogram.</td></tr>
<tr><td>13</td><td>33 kV Underground Cable from Khushi Grid to Nasirabad 33/11 kV Substation BPDB, Chattogram.</td></tr>
</table></td></tr>
<tr><td>GCC 1.1 (vv)</td><td>The Works consist of

As mentioned in Section 6. Scope of works and Bill of Quantities, Section 7, General Specification (Technical) and Section 8, Guaranteed Technical Particulars (GTP) Section 9, Drawing.</td></tr>
<tr><td>GCC 2.5</td><td>Sectional Completion: Not Applicable for individual Sub-station.</td></tr>
<tr><td>GCC 3.1</td><td>The Procuring Entity’s address for the purpose of communications under this contract is :
Project Director, Power Distribution System Development, Chattogram Zone (2nd</td></tr>
</table>

	Phase), Bidduyut Bhaban (5th Floor), Agrabad BPDB, Chattogram. Camp Office: Bidduyut Bhaban (15th Floor),1 No. Abdul Goni Road, BPDB, Dhaka. E-mail: pd.pdsd2.cz@gmail.com Phone: +8801708168864, +8801708168866
	The Contractor's address for the purpose of communications under this contract is : Contact person: Address: Tel: Fax: e-mail address:
GCC 6.1 (k)	Other documents forming part of the Contract are; Acceptance of NOA, Performance Security, Tender/Proposal (Offer) of the Contractor and All Correspondences between purchaser and Contractor prior to signing of the contract.
GCC 9.2	Materials, Equipment Plants and supplies shall not have their origin in the following countries: Israel and countries having no diplomatic relation with the Government of Bangladesh. Plant and services from a country which is not included in the specified countries mentioned in the respected GTP in Section 8: Guaranteed Technical Particulars is also not acceptable.
GCC 13.1	Possession of the Site or part(s) of the Site, to the Contractor shall be given on the following date(s); Within 14 days after LC Opening by the Employer.
GCC 23.1	The Contractor shall commence work on the Facilities within 07 **(Seven)** days from the Effective Date for determining Time for Completion as specified in the Contract Agreement.
GCC 24.1	The time for completion of the whole of the facilities shall be: **730 (Seven hundred and thirty)** days calculated from the Effective Date of Contract to acceptance of Commissioning and Guarantee test run.
GCC 32.1	A Subcontractor that is a national of, or registered in, the following countries are not eligible: Israel and countries having no diplomatic relation with the Government of Bangladesh.
GCC 33.1	Nominated Subcontractor(s) named below: None shall be entitled to execute the following specific components of the Works Not Applicable.
GCC 35.3.2	**Design and Engineering:** Design, Drawing, Specification & GTP/ Engineering Data etc., shall be submitted to the Engineer, Director, Design & Inspection–II, BPDB by the Contractor for approval, prior to the starting of works and manufacturing of the goods. The Supplier/Contractor shall have to submit 3 (three) sets of the same for approval within **15 (fifteen) days** from the date of signing Contract. Only Original copy shall be submitted (photocopy / scanned copy will not be allowed). One copy of Design, Drawing, Specification & GTP/ Engineering Data shall be returned to the Contractor/Supplier marked "APPROVED" or "APPROVED AS NOTED" or "RETURNED FOR CORRECTION" within **14 (Fourteen) working days** after receipt from the Supplier and if not returned within**14 (Fourteen) working days** after receipt by the Engineer, the Suppliers shall notify Engineer of such fact, and if the Design, Drawing, Specification & GTP/ Engineering Data still have been not returned within **10 (ten)**

working days after notice, the Supplier may proceed as if Design, Drawing, Specification & GTP/ Engineering Data have been returned approved. When the Design, Drawing, Specification & GTP/ Engineering Data are returned marked "APPROVED AS NOTED" or "RETURNED FOR CORRECTION" the corrections or changes shall be made and 3 (three) revised copies shall be submitted to the Engineer. One copy of the revised Design, Drawing, Specification & GTP/ Engineering Data will be returned to the Supplier by **7(Seven) working days** from the receipt of the same with due approval, if re-submitted Design, Drawing, Specification & GTP/ Engineering Data are in line with the earlier comments of the Engineer and satisfy contract specification.

Approval of data and drawings shall in no way relieve the Contractor of any of his duties or responsibilities for engineering, design, workmanship, materials and all other liabilities under the Contract.

The contractor shall, within the time specified, provide drawings showing the manner in which the equipment and materials is to be affixed together with all information relating, unless otherwise agreed, only to the Works, required for preparing suitable foundations, for providing suitable access for equipment and materials and any necessary equipment which are to be erected and for making all necessary connections to the equipment and materials (whether such connections are to be made by the Contractor under the Contract or not).

Any expenses resulting from an error or omission in or from delay in delivery of the drawings and information mentioned in this Clause shall be borne by the Contractor. The Contractor shall be responsible for any discrepancies, errors, or omissions in the drawings and other particulars supplied by him. Whenever the work is carried out on the basis of such discrepancies, errors, or omissions, any revision of the work shall be made at the expense of the Contractor.

At least one copy of the final approved data and drawings shall be kept by the Contractor at the Site and the same shall at all reasonable times be available for inspection and use by the Employer/Engineer and by any other person authorized by the Employer/Engineer.

AUTHORITY OF THE ENGINEER:

To prevent delays and disputes, and to discourage litigation, it is agreed by the parties to this Contract that the Engineer shall resolve, by written opinion, all questions in relation to the Work performed under this Contract. In case of any decision or instruction involving financial implications, the Engineer shall obtain written confirmation from the Employer and advise the Contractor accordingly. The Engineer shall issue instructions in consultation with the Consignee. If, in the opinion of the Contractor or the Employer, a written decision made by the Engineer is not in accordance with the meaning and intent of the Contract, either party may file with the engineer and the other party to the Contract, within thirty (30) days after receipt written decision, a written objection to the decision.

Failure to file an objection within the allotted time will be considered as acceptance of the Engineer's decision and the decision shall become final and conclusive. If such written objection is timely filed, the objecting party may at any time thereafter and prior to final payment under the Contract, request that the matter be referred to arbitration pursuant to the provisions hereinafter setforth in Clause "Arbitration". The Engineer's decision and the filing of the written objection thereto shall be Conditions precedent to the right to request arbitration or to start action in court.

It is the intent of this agreement that there shall be no delay in the execution of the Work,

	and the decision of the Engineer as rendered shall be promptly observed. The Contractor shall proceed with the Work in accordance with the Engineer's written decision, provided, however, that the Contractor shall not be requested to recognize or accept any change order or decision requiring extra or additional Work, unless the amount of additional compensation therefore is agreed upon by the Employer in accordance with the provisions of Clauses GCC 1.1 (qq) and GCC 35.3.5 pertinent to modifications. If in any case, the Contractor is required to proceed over his objection, the Contractor shall be authorized, in an appropriate case, to notify the Employer. **WORK TO THE SATISFACTION OF THE EMPLOYER/ ENGINEER:** The Contractor shall execute and complete the Work in strict accordance with the Contract to the satisfaction of the Employer /the Engineer and shall comply with and adhere strictly to the Engineer's instructions and directions on any matter, whether mentioned in the Contract or not, concerning the Work. The Contractor shall take instructions and directions only from the Engineer. Such instruction by the Engineer shall always be in writing and approved by the Employer.
GCC38.2	Replace the clause as follows: **[A] Pre-delivery inspection and/or Witnessing of the manufacturing process and tests of the equipment at manufacturer's works including transfer of technical know-how.** During test, transfer of Technology and Technical know-how regarding spares, parameters and testing procedure including familiarization/ testing of equipment's to BPDB Engineers is to be performed. Within 07 days after signing of Contract, the Contractor/Supplier shall inform BPDB details of Pre-Shipment Inspection/Factory Acceptance Test such as Name of equipment/machine/materials/goods/parts/spares are to be tested/inspection, Name of tests/Inspection, time schedule, Period of Technical Orientation and Quality Test Witness, location/place of inspection, duration of inspection/test etc. Tests shall be performed as per procurement contract of BPDB, relevant IEC standard and only routine tests as agreed upon, will be performed. For any reason, if Purchaser's/ Employer's representative(s) cannot attend the "Pre-delivery inspection and/or Witnessing of the manufacturing process and tests of the equipment at manufacturer's works including transfer of technical know-how" Program, a Third Party Inspection Company/Agency shall conduct the witness Pre-shipment Inspections as well as Factory Acceptance Tests as per Contract and relevant standard at the manufacture's Premises with the concurrence of BPDB. The Third Party Inspector shall submit a comprehensive report to Purchaser with recommendation accompanied with picture, video clips (with date and time stamp) with Inspector(s) and Manufacturer's representatives(s) at the test/inspection venue of the Equipment/ Materials/ Goods inspected within 7 days after completion of respective inspection/Test. After approval of Third Party Inspection report by BPDB, shipping advice shall be issued to Supplier/ Contractor. No Equipment/ Materials/ Goods shall be shipped without shipping advice. BPDB shall bear cost related to third party inspection team/BPDB's representative(s). Manufacturer/Supplier shall facilitate and provide full support for the Pre-Shipment Inspection/Witnessing of Factory Acceptance Test and transfer of technical know-how to BPDB representative(s). The cost of performing any tests shall be borne by the Contractor. The cost of subsequent inspection(s) including all inspectors' inspection pertinent costing due to rejection/additional re-testing of Goods at the first inspection shall also be borne by the Contractor. The third party inspection company/agency must not be involved in design, procurement,

fabrication, construction and installation under this Contract.
Third party inspection is applicable for Equipment/ Materials/ Goods manufactured outside in Bangladesh.

As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect.

Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the items or complete batch if necessary. In that case Supplier has to replace the Equipment and to make good of them without any financial involvement to the Purchaser. In case any of the Equipment found not conforming with the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them or making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

No goods shall be packed, prepared for shipment / delivery unless it has been approved including Test reports and written instruction has been issued by the Purchaser.

Such witness/inspection shall not relieve the supplier from any obligation to supply the goods in accordance with contract document.

Total 30 (thirty) nos. of Engineer (nominated by the Purchaser) in **nine** groups (Engineering Team) will participate on the quality acceptance test (QAT) for the offered equipment at the manufacturer's plant and confirm their quality as per specification. The Purchaser's nominated "Engineering Team" shall have the witness of the QAT of the goods on the manufacturer's premises.

Group	Nos. of Engineer	Name of the Equipment
Team-1	03	Power Transformers, Station Auxiliary Transformers.
Team-2	03	Power Transformers, Station Auxiliary Transformers.
Team-3	03	33kV GIS Breaker with Panel.
Team-4	03	33kV GIS Breaker with Panel.
Team-5	02	Sub Station Automation System (SAS).
Team-6	03	11 kV GIS Breaker with panel.
Team-7	03	11 kV GIS Breaker with panel.
Team-8	03	33kV & 11kV XLPE Power Cable & Kits.
Team-9	03	33kV & 11kV XLPE Power Cable & Kits.
Team-10	02	Battery & Battery Charger, 33kV & 11kV LA.
Team-11	02	CT, PT, Isolator, Outdoor VCB and PCM Panel.

[B] Post Landing Inspection (PLI):

i. Post Landing Inspection shall be done by inspection team formed by competent authority of BPDB after arrival of the Plant/Goods at Final destination or at site. The post landing inspection program shall be intimated by the representative of Contractor/Supplier after arrival of the Plant/Goods at Final destination or at site.

ii. The purchaser will test and where necessary reject the Goods arrived in purchaser's store/Site shall in no way be limited or waived by reason of the goods having previously been tested and passed by the manufacturer/supplier/ contractor.

iii. Nothing in this clause shall in any way release the supplier/contractor from any

	warranty or other obligation under the provisions of the contract/ purchase order. **[C] Technical Orientation & witness of the Plant & Equipment (for each sub-station) for 03 (three) days after Commissioning of the Plant & Equipment at Project Site's and/or in classroom including transfer of technical know-how:** During Technical Orientation & witness, transfer of Technology and Technical know-how regarding spares, parameters and testing & manufacturing procedure including familiarization/ testing of equipment to BPDB Engineers/Employer (persons) at on Project's Site and/or in Classroom is to be performed by the expertise of the Plant & Equipment Manufacturer's as per Section 7. The Contractor/Supplier shall bear all cost required for accommodations, class room rent, foods, internal transportations to carry out the Technical Orientation & witness by the BPDB Engineers'/Employer (persons) for 3 (three) days (excluding any travel time). The number of such BPDB Engineers/Employee will be 08 (eight) nos. for each Sub-Station. Such Orientation & witness will required for issuing **Operational Acceptance Certificate (OAC)** and shall not relieve the supplier from any obligation to supply the goods in accordance with contract document.
GCC 40.1.2	Replace the Clause as follows: Before commissioning the, Employer will provide operating and maintenance personnel under Contractor's supervision to get them (Employer's O&M personal) acquainted with and to witness the commissioning of the Plant & Equipment. The commissioning program shall be intimated by the Contractor before 07(seven) days of commissioning. All raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning shall be supplied by the Contractor.
GCC 40.2.2	Before commencement of Guarantee test (As mentioned in appendix 8) Contractor will successfully complete Initial Commercial Operation (ICO) of Plant and Facilities as mentioned in GCC Sub-Clause 39.11 thereof. If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period **30 (thirty) days** from the date of successfully completion of ICO, Operational Acceptance Certificate (OAC)/ **Provisional Acceptance Certificate** PAC may be issued subjected to GCC Sub-Clause 40.3.1 hereof. But Contractor shall have to perform Guarantee Test with the connected maximum load of the substation (for 3 days) as soon as Employer request for the same.

GCC40.3.1 **(Missing Clause)**	Add the Clause 40.3.1 (**Operational Acceptance/ Provisional Acceptance**) as follows: Subjected to GCC Sub-Clause 40.4 below, Operational Acceptance/ Provisional Acceptance shall occur in respect of Facilities or any part thereof when a. the Guarantee Test has been successfully completed and the Functional Guarantee are met; or b. the Guarantee Test has not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the period from the date of Completion or any other agreed upon period as specified in GCC Sub-Clause 40.2.2 or c. the Contractor has paid the liquidated damages specified in GCC Sub-clause 43.3 hereof; and d. any minor items mentioned in GCC Sub-Clause 39.9 hereof relevant to the Facilities or that part thereof have been completed; and e. Successfully carry out the Technical Orientation and Quality Test Witness of Plant & Equipment and any part of the Facilities specified hereof. f. Approved As-Built Drawing.
GCC 40.4	Partial Acceptance of Plant and Facilities are allowed on the basis of successful completion of commissioning and Guarantee Test of a particular Sub-station.
GCC 41.2	The amount of Liquidated Damages for Delay or Delay Damages or Delay to Completion Date of the uncompleted delivery of goods/works/services or for any part thereof is**:** At the rate of zero point one percent (0.1%) of the Contract Price of relevant part per day. All Goods, whole works and related services shall be considered as uncomplete until the effective date of Operational Acceptance Certificate (OAC)/ Provisional Acceptance Certificate (PAC). Hence Liquidated Damages for delay or Delay Damages until effective date of OAC/PAC shall be applicable on the final Contract Price of the whole of the Goods, Works and related services. The maximum amount of Liquidated Damages is: Ten percent (10%) of the final Contract price of the Whole of the Goods, Works and related services.
GCC 41.3	No bonus will be given for earlier Completion of the Facilities or part thereof.
GCC42.2	The warranty /defect liability period hereunder shall begin from the date of issuance of **Operational Acceptance Certificate (OAC)/Provisional Acceptance Certificate (PAC)** for a particular Sub-station by BPDB and shall end after 12 **(twelve) months** pursuant to GCC Sub-Clause 42.10.
GCC 42.3	The amount to be withheld for late submission of an updated Programme is **Not Applicable.**
GCC 42.9	"after Completion of the Facilities or any part thereof," will be replaced by "after Operational Acceptance of Facilities,"
GCC 42.10	During the Defect Liability Period, if any Plant & Equipment is damaged and replaced by the Contractor, fresh Defect Liability Period for **12 (twelve) months** of operation shall be counted for replaced Plant & Equipment from the date of repair, replacement, commissioning thereof.

GCC 42.11 **(New Clause)**	**<u>Final Acceptance Certificate (FAC):</u>** The "Final Acceptance Certificate (FAC)" shall mean the official notification by Employer to the Contractor, issued at the end of all the Defect Liability Period (if different guarantee periods to different parts of the work, after the expiration of the latest of such periods) which indicates that the Contractor has completed his obligation under the Contract.
GCC45.1 (b)	The multiplier of the Contract Price is: One (1).
GCC47.1	"until the date of Completion of the Facilities pursuant to GCC Clause 39 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part" **will be replaced by** "until the date of Operational Acceptance of the Facilities pursuant to GCC Clause 40.3 or, where the Contract provides for Completion of the Facilities in parts, until the date of Operational Acceptance of the relevant part"
GCC 56.2	The Contract Price shall be adjusted in accordance with the provisions of the Appendix to the Contract Agreement titled Adjustment Clause. **Not Applicable**
GCC57.1	As per Appendix-1. **Terms and procedures of Payment.**
GCC 57.5 **(New Clause)**	Payments due to the Contractor in each certificate shall be made into the following Bank Account nominated by the Contractor and in the currency as specified in the Payment Schedule: The particulars of the Bank Account nominated are as follows : Title of the Account: [insert title to whom the Contract awarded] Name of the Bank : [insert name with code, if any] Name of the Branch : [insert branch name with code ,if any] Account Number : [insert number] Address : [insert location with district] Tel: Fax: e-mail address:
GCC59.1	The Contractor shall, within twenty-eight (28) days of the notification of contract award (NOA), provide a security for the due performance of the Contract in the amount, as a percentage of the Contract Price for the Facility or for the part of the Facility for which a separate Time for Completion is provided, shall be: Ten percent (10%).
GCC59.2	The performance security shall be provided in the currency or currencies of the Contract as stated under ITT Sub Clauses 27.4 at the percentage as specified in GCC 59.1 and shall be in the form of an irrevocable Bank Guarantee issued by an internationally reputable Bank which has a correspondent Bank located in Bangladesh in the Format **(Form PG5A-9)** provided in Section 5, Tender and Contract Forms, acceptable to the Employer.
GCC59.3	Performance Security shall not be reduced. The performance security shall be valid until completion of Defects Liability Period plus 28 (twenty eight) days, provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 42.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part.
GCC 60.4	**1. <u>For Contractor's equipment materials & Service:-</u>**

Taxes and Duties (New Clause)	a) **Bangladesh Income Tax and VAT for Income Earned in Bangladesh:** i) The Contractor shall be entirely liable to pay **Income Tax** for payment of Foreign & Local Currency under the contract amount (including CIF or CIP) according to income tax ordinance 1984. Income tax shall be deducted at source during payment of bills/Invoice at the prevailing rate (at the tender submission date) and onward deposition into Govt treasury. If any changes the Tax rate on the payment date that will be on account of Employer. ii) The Contractor shall not be responsible for payment of applicable VAT on the Import materials and equipment on import price. The employer will pay the VAT on Import stage. If any difference of import price and contract price that shall be accumulated or settled according to VAT Act 2012. The contractor shall be liable to pay VAT on local and foreign portion on service, Civil and commissioning works on payment stage at the prevailing rate (at the Tender submission date) of Govt according to VAT Act.2012.If any changes the VAT rate on the payment date that will be on account of Employer . b) **Foreign country Taxes and Permits:** The Contractor shall pay all sales, income and other taxes and duties, tariffs and imports that can be lawfully assessed against the contractor by the Government or any lawful authority of any country other than the people's Republic of Bangladesh which has jurisdiction over the contractor in connection with this contract and shall pay for all licenses permits and inspection required for the work including the cost or securing all export licenses and permits for materials, equipment, supplies and personnel exported from that country to Bangladesh. c) **For Contractor's equipment, materials imported on re-exportable basis:** The Contractor shall be entirely responsible for all Bangladesh Custom and Import duties, VAT, taxes and all other levies imposed under applicable law of Bangladesh for Importation of Contractor's Construction equipment, tools and materials required for implementation of the contract in Bangladesh which shall be imported on the condition to be exported after completion of the work, if the same are not exempted from such taxes, VAT & levies. The Board shall assist to the contractor to obtain exemption from NBR [National Board of Revenue] for import of the contractor's equipment and materials on the basis of re-export. **2. Import Duty, VAT, Taxes, Levies and other Taxes for Permanent Materials of the project:** The Board shall pay all Bangladesh Customs and Import duties, VAT, Taxes and all other liabilities arising from the Importation of all permanent Materials and equipments under the contract. The Contractor shall obtain all import permits or licenses required for any part of the work within the terms stated in the program or if not so stated, in reasonable time having regard to the time for delivery of the work and the time for completion. **The Board shall pay all Bangladesh customs and import duties, VAT, taxes and all other levies arising from the importation of all permanent materials and equipment (on CIP Value)** under the contract, The Board shall provide its extreme effort to pay such taxes in a timely manner to avoid any extra cost thereon. The contractor shall submit to the owner 5 (five) copies of non-negotiable shipping document ahead of shipment for arranging payment of such taxes and clearing the materials in time. The Board shall not bear any expenditure on account of import of cement, if any, by the Contractor. Normally, equipment and materials that will be incorporated in the permanent works shall be transported by vessel. If the Contractor decides to air freight any items, the excess freight beyond freight of vessel or excess inland transportation or any other additional cost on account of air freight shall be borne by the Contractor

	C&F: Manufacturer/supplier/contractor shall be entirely responsible for clearing the material//equipment through their appointed clearing agent (including necessary payment to them), submission of tax assessment report from custom authority to Deputy Director clearance & Movement , BPDB, Rangpur/Dhaka/Khulna/Chattogram ahead of time period to avoid any sorts of demurrage. On presentation of assessment report from custom authority, concerned Deputy Director Clearance & Movement, BPDB will make arrangement for payment to custom authority. All charges related to tax assessment & Clearing shall be borne by the contractor if necessary.
GCC 63.1	The Amount of Liquidated Damages for Delay or Delay Damages or Delay to Completion Date of the incomplete delivery of goods/works/services or for any part thereof is**:** At the rate of zero point one percent (0.1%) of the Contract Price of relevant part per day. All Goods, whole works and related services shall be considered as incomplete until the effective date of Operational Acceptance Certificate (OAC)/ Provisional Acceptance Certificate (PAC). Hence Liquidated Damages for delay or Delay Damages until effective date of OAC/PAC shall be applicable on the final Contract Price of the whole of the Goods, Works and related services.
GCC 63.2	The maximum amount of Liquidated Damages is: **Ten percent (10%) of the final Contract price of the Whole of the Goods, Works and related services.**
GCC 72.3	As per Bangladesh Arbitration Act. Place: Dhaka, Bangladesh .
GCC 73.1 List Delivery Document (New Clause)	Subject to GCC Clause 64, the Delivery of the Plants and Services shall be in accordance with the Delivery and Completion Schedule specified in the Section 6: Schedule of Requirements. Details of shipping and documents to be furnished by the Contractor/Supplier shall be: "**For Schedule No. 1 - Plant and Equipment Supplied from Abroad / Goods supplied from abroad as per INCOTERM CIP**: Upon shipment, the Contractor/Supplier shall notify the Purchaser by telex or fax the full details of the shipment, including Contract number, description of Goods, quantity, the vessel, the bill of lading number and date, port of loading, date of shipment, port of discharge, etc. The Contractor/Supplier shall send the following documents to the Purchaser, with a copy to the Insurance Company: (a) 7 copies of the Supplier's invoice showing the description of the Goods, quantity, unit price, and total amount; (b) original and 8 copies of the negotiable, clean, on-board bill of lading marked "freight prepaid" and 8 copies of non-negotiable bill of lading where applicable; (c) 8 copies of the packing list identifying contents of each package; (d) insurance certificate; (e) Manufacturer's or Supplier's warranty certificate; (f) inspection certificate, issued by the nominated inspection agency or purchaser inspection team, and the Supplier's factory inspection report; and (g) Certificate of origin. (h) Shipping advice issued by the Consignee (i) Truck Challan:

	The Employer/Consignee shall receive the above documents at least one week before arrival of Goods at the port and, if not received, the Supplier will be responsible for any consequent expenses. The negotiable sets of documents shall be originals signed by the Supplier. The Commercial Invoice is to show material value plus freight as applicable. The Employer/Consignee shall receive the shipping documents at the latest one-week before arrival of cargoes at the airport of Dhaka or any sea/land port of entry in Bangladesh. The shipping documents shall be supplied to as follows: 1 | Project Manager/Consignee Project Director Power Distribution System Development Project (Phase-2), Chottogram Zone, BPDB, Chottogram. | 2 (Two) sets 2 | Director, Finance, Biddut Bhaban (7th Floor)1, Abdul Gani Road, Dhaka-1000 | 2 (Two) sets 3 | Director, Clearance & Movement, BPDB, Chittagong/Dhaka | 2 (Two) sets 4 | Deputy Director, Clearance & Movement BPDB, Chittagong/Dhaka /Khulna | 1 (one) set 5 | Dy. Director, Insurance, BPDB, Dhaka | 1 (one) set
	No goods should be shipped or delivered without prior instruction (shipping advice) from the Employer/Consignee. **For Goods from within the Purchaser's country as per INCOTERM EXW:** Upon delivery of the Goods to the transporter, the Supplier shall notify the Employer/Consignee and send the following documents to the Employer/Consignee: (a) 7 copies copies of the Supplier's invoice showing the description of the Goods, quantity, unit price, and total amount; (b) 7 copies delivery note, railway receipt, or truck receipt; (c) 3 copies Manufacturer's or Supplier's warranty certificate; (d) 7 copies inspection certificate issued by the nominated inspection agency, and the Supplier's factory inspection report; and (e) 7 copies certificate of origin. The Employer/Consignee, shall receive the above documents before the arrival of the Goods and, if not received, the Supplier will be responsible for any consequent expenses.
GCC 74.1 **(New Clause)**	**SUBMISSION OF "as-build" Drawing of the Plant:** The Contractor shall submit "as-build" drawing including Approval/ Testing Report/ Operational/ Maintenance Manual within one month from the date of Completion Certificate to the Project Manager. All documents including Drawing/ Testing Report/ Operational/ Maintenance Manual must be submitted in English language. If the Contractor does not supply the Drawings and/or Manuals by the dates specified above or they do not receive the Engineer's approval, than No money will be withheld but Operational Acceptance Certificates (OAC) or FAC shall not be issued until the submission of "**as-built**" drawings and/or operating and maintenance manuals.
GCC 75.1 **(New Clause)**	**CLEAN UP OF SITE:** The Contractor shall clean the working areas periodically of all trash and waste materials and shall maintain the Site in a neat and orderly condition throughout the construction period. The Engineer shall have the right to determine what is waste material or rubbish and the manner and place of disposal. On or before the completion of the Work the Contractor shall, without charge there for, carefully clean out all pits, pipes, chambers or conduits, and shall tear down and remove

	all temporary structures built by him, and shall remove all rubbish of every kind from the tracts or grounds which he has occupied and shall leave them in first class condition. In the event that the Contractor fails to comply with the cleanliness requirement or to perform the cleanup work assigned to him by the Board. the Board will reserve the right to hire another contractor to perform the necessary cleaning work and the Contractor shall reimburse the Board or the cost of all such clean-up work.
GCC77.1 **(New Clause)**	**Release of Liability:** The acceptance by the Contractor of the last payment shall operate as, and shall be, a release to the BOARD and every officer, agent and employee thereof, from all claims and liability hereunder for anything done or furnished for or relating to the work, or for any act or neglect of the BOARD or of any person relating to or the affecting the work. The last payment by the BOARD to the Contractor shall constitute final acceptance of all work performed under this Contract and shall release the Contractor and his surety, from all Contractual liabilities and responsibilities to the BOARD except these liabilities assumed under the Defect Liability period/ Warranty period/Functional Guarantees clause PCC [GCC 42] of these Special Conditions or arising out of hidden defects. In the event a suit were to be instituted in Bangladesh against the BOARD and the Contractor as defendants neither shall be released from his respective liabilities under this Contract.

Appendix to the Tender

[In Tables below, the Procuring Entity shall indicate the source and base values with dates of Indexes, unless otherwise instructed to be quoted by the Tenderer, for the different Cost Components and mention its Weightings or Coefficients]

Table 1.1: Price Adjustment Data

[ITT Sub Clause 26.9: To be provided by the Procuring Entity]

Index Descriptions	Base Value	Sources of Index

Note:

1. **The sources of Indexes and its values with dates shall be Bangladesh Bureau of Statistics (BBS) unless otherwise mentioned by the Procuring Entity or instructed to be quoted by the Tenderer.**
2. **The Procuring Entity may require the Tenderer to justify its proposed Indexes, if quoted by the Tenderer.**
3. **The Base Value of the Indexes shall be those prevailing twenty eight (28) days prior to the deadline for submission of the Tenders.**

Table 1.2: Price Adjustment Data

[GCC Sub Clause 56.4: To be provided by the Procuring Entity]

Item Group	Bill No. if applicable	Index Descriptions	Coefficients or Weightings for non-adjustable Cost Component	Coefficients or Weightings for adjustable Cost Components										Total
				a	b	c	d	e	f	g	h	i	j	
														1
														1
														1
														1
														1
														1

Note:

The Weightings or Coefficients of the Cost Components shall be mentioned by the Procuring Entity based on the proportion of components involved in the items caused to be impacted by rise and fall in its prices.

APPENDICES [This appendixes shall be the part of the contract]

Appendix 1 - Terms and Procedures of Payment
Appendix 2 - Price Adjustment
Appendix 3 - Insurance Requirements
Appendix 4 - Time Schedule
Appendix 5 - List of Major Items of Plant and services and List of Approved Subcontractors
Appendix 6 - Scope of Works and Supply by the Employer
Appendix 7 - List of Documents for Approval or Review
Appendix 8 - Functional Guarantees
Appendix 9- Article(s)

Appendix 1. Terms and Procedures of Payment

In accordance with the provisions of GCC Clause 57 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on Price Schedules. Payments will be made in the currencies quoted by the Tenderer unless otherwise agreed between the parties. Applications for payment in respect of part deliveries may be made by the Contractor as work proceeds in a manner described as below.

(A) Terms of Payment:

Schedule No. 1 - Plant and Equipment Supplied from Abroad

In respect of plant and equipment supplied from abroad, the following payments shall be made:

i) **Advance Payment:** Ten percent (10%) of the total CIP amount as an advance payment against receipt of invoice and an irrevocable and unconditional advance payment security for the equivalent amount made out in favour of the Employer. The advance payment security shall remain valid until issuance of Operational Acceptance Certificate (OAC). The advance payment security may be reduced in proportion to the value of the plant and equipment delivered to the site, as evidenced by shipping and by delivery documents.

ii) **On Shipment:** Fifty percent (50%) of the total or pro rata CIP amount upon Incoterm "CIP," upon delivery to carrier shall be paid through letter of credit opened in favour of the contractor/supplier in a bank in its country upon submission of documents specified in **PCC clause 73.1** with invoices duly verified by Project Office, certified by Engineer and approved by the the Project Director.

iii) **On Acceptance of PLI Report:** Twenty percent (20%) of the total or pro rata CIP amount upon issue of the Post Landing Inspection report as specified in PCC 38.2 for each consignment delivered at site, issuance of Receiving Cum Inspection Report and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

iv) **On Operational Acceptance Certificate /PAC:** Ten percent (10%) of the total or pro rata CIP amount upon issue of the Operational Acceptance Certificate (OAC) as specified in GCC 40.3 and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

v) **On Final Acceptance Certificate (FAC) :** Ten percent (10%) of the total or pro rata CIP amount upon issue of the Final Acceptance Certificate (FAC) as specified in PCC Sub-clause GCC42.11 and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

Schedule No. 2 - Plant and Equipment Supplied from within the Employer's Country

In respect of plant and equipment supplied from within the Employer's country, the following payments shall be made:

i. **Advance Payment:** Ten percent (10%) of the total EXW amount as an advance payment against receipt of invoice, and an irrevocable unconditional advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security shall remain valid until issuance of Operational Acceptance Certificate (OAC). The advance payment security may be reduced in

proportion to the value of the plant and equipment delivered to the site, as evidenced by delivery documents.

ii. **On Delivery and PLI Report:** Seventy percent (70%) of the total or pro rata EXW amount upon Incoterm "Ex-Works," upon delivery to the designated site and upon issue of the Post Landing Inspection report as specified in PCC 38.2 for each consignment delivered at site, issuance of Receiving Cum Inspection Report and submission of documents specified in **PCC clause 73.1** with a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

iii. **On Operational Acceptance Certificate /PAC:** Ten percent (10%) of the total or pro rata EXW amount upon issue of the Operational Acceptance Certificate (OAC) as specified in GCC 40.3 and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

iv. **On Final Acceptance Certificate (FAC):** Ten percent (10%) of the total or pro rata EXW amount upon issue of the Final Acceptance Certificate (FAC) as specified in PCC Sub-clause GCC42.11 and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

Schedule No. 3 - Design Services

In respect of design services for both the foreign currency and the local currency portions, the following payments shall be made:

i. **Advance Payment:** Ten percent (10%) of the total design services amount as an advance payment against receipt of invoice, and an irrevocable unconditional advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security shall remain valid until issuance of Operational Acceptance Certificate (OAC).

ii. **On Acceptance of Design:** Seventy percent (70%) of the total or pro rata design services amount upon acceptance of design in accordance with GCC Clause 35 by the Engineer and upon issue of Approval Certificate/Letter from Engineer and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

iii. **On Operational Acceptance Certificate /PAC:** Ten percent (10%) of the total amount for individual sub-station's design services upon acceptance of design in accordance with GCC Clause 35 and upon issue of the Operational Acceptance Certificate (OAC) as specified in GCC40.3 and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

iv. **On Final Acceptance Certificate (FAC) :** Ten percent (10%) of the total or pro rata design services amount upon issue of the Final Acceptance Certificate (FAC) as specified in PCC Sub-clause GCC42.11 and a claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

Schedule No. 4 - Civil Works

In respect of installation services for both the foreign and local currency portions, the following payments shall be made:

i. **Advance Payment:** Ten percent (10%) of the total civil works amount as an advance payment against receipt of invoice, and an irrevocable unconditional advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security shall remain valid until issuance of Operational Acceptance Certificate (OAC). The advance payment security may be reduced in proportion to the value of civil works performed at site, as evidenced by progress report.

ii. **On monthly Progress Report:** Seventy percent (70%) of the measured value of work performed satisfactorily by the Contractor, as identified in the said Program of Performance or in Contractors' breakdown estimate, during the preceding month, will be made monthly after receipt of invoice/claim bill duly verified by Project Office & Directorate of Design & Inspection-III, BPDB, certified by Engineer and approved by the the Project Director.

iii. **On Operational Acceptance Certificate /PAC:** Ten percent (10%) of the total or pro rata value of work for individual sub-station's performed satisfactorily by the Contractor as identified in the said Program of Performance or in Contractors' breakdown estimate, upon issue of the Operational Acceptance Certificate (OAC) as specified in GCC40.3, will be made after receipt of invoice/claim bill duly verified by Project Office and Directorate of Design & Inspection-III, BPDB, certified by Engineer and approved by the the Project Director.

iv. **On Final Acceptance Certificate (FAC):** Ten percent (10%) of the total or pro rata value of work for individual sub-station's performed satisfactorily by the Contractor as identified in the said Program of Performance or in Contractors' breakdown estimate, upon issue of the Final Acceptance Certificate (FAC) as specified in PCC Sub-clause GCC42.11, will be made after receipt of invoice/claim bill duly verified by Project Office & Directorate of Design and Inspection-III, BPDB, certified by Engineer and approved by the the Project Director.

Schedule No. 5 - Installation and other Services

In respect of installation services for both the foreign and local currency portions, the following payments shall be made:

i. **Advance Payment:** Ten percent (10%) of the total installation and other services amount as an advance payment against receipt of invoice, and an irrevocable unconditional advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security shall remain valid until issuance of Operational Acceptance Certificate (OAC). The advance payment security may be reduced in proportion to the value of installation and other services performed at site, as evidenced by progress report.

ii. **On monthly Progress Report:** Seventy percent (70%) of the measured value of Installation and Services work performed satisfactorily by the Contractor, as identified in the said Program of Performance or in Contractors' breakdown

estimate, during the preceding month, will be made monthly after receipt of invoice/claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

v. **On Operational Acceptance Certificate /PAC:** Ten percent (10%) of the total or pro rata value of installation services for individual sub-station's performed by the Contractor as identified in the said Program of Performance or in Contractors' breakdown estimate, during the preceding month, upon issue of the Operational Acceptance Certificate (OAC) as specified in GCC40.3, will be made after receipt of invoice/claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

vi. **On Final Acceptance Certificate (FAC):** Ten percent (10%) of the total or pro rata value of installation services for individual sub-station's performed by the Contractor as identified in the said Program of Performance or in Contractors' breakdown estimate, during the preceding month, upon issue of the Final Acceptance Certificate (FAC) as specified in PCC Sub-clause GCC42.11, will be made after receipt of invoice/claim bill duly verified by Project Office, certified by Engineer and approved by the the Project Director.

Note: The Payment-delay period after which the Purchaser shall pay interest to the Contractor/Supplier shall not allowed. No interest will be applicable for delayed payment.

(B) Payment Procedures

The procedures to be followed in applying for certification and making payments shall be as follows:

Payments under this Contract shall be effected in the currency of the Tender for Foreign Currency and in Taka for local currency.

1 **Local Currency [BDT]**

Payment of Local currency portion (where applicable) shall be made direct through transfer [EFT] of fund to Contractor's account or through cheque. Payment shall be made direct through Consignee.

2 **Foreign Currency**

Payment of foreign currency portion shall be made through Letter of Credit (L/C) opened in favour of the contractor/supplier in a schedule Bank of Bangladesh.

BANKING CHARGES:

- Letter of Credit opening and other charges including amendment charges within Bangladesh shall be borne by BPDB and those outside Bangladesh shall be borne by the contractor/supplier.
- The supplier shall have to bear all such charges both inside and outside Bangladesh in case of extension of L/C if done at the request of the contractor/ supplier.

3 **Invoices**

The Contractor shall submit invoices (original) in triplicate to the Project Manager whenever an invoice is required to be submitted as per provision of this Contract. Invoices should be duly certified by Project manager.

4 **Documentation Required for Payment**

Submission of delivery documents as stated under Clause GCC 73.1

(C) Payment Procedure for monthly Progress Report against Civil, Installation & Services work:

On or about the first day of each month the Contractor will prepare a bill in prescribed form of the value (As per Breakdown estimate submitted by Contractor) for the Civil/Installation & Services work done up-to such date. The estimated cost of Civil/Installation & Services work which, do not conform to the specifications will be deducted from the billed amount. Payment will be made to the Contractor as stipulated above. Such intermediate payment shall be regarded as payment by way of advance against the final payment for work actually done and shall not preclude the requiring of bad, unsound and imperfect work to be removed and reconstructed. Such payments shall not be considered as admission that the Contract performance has been completed nor shall it indicate the accruing or any claim, or shall it conclude, determine or affect in any way the powers of BPDB under this Contract to final settlement and adjustment of the account or in any other way vary or affect the Contract.

Contractor's Breakdown Estimate

The Contractor shall prepare and submit to the Consignee for approval a breakdown estimate for and covering each lump-sum price stated in the Contract. The breakdown estimate, showing the value of each kind of service shall be certified by Consignee and approved by the Engineer before any partial payment estimate is prepared. Such items as bond premium, temporary facilities and plant may be listed separately in the breakdown estimate, provided that their cost can be substantiated.
The sum of the items listed in any breakdown estimate shall equal the Contract lump-sum price or prices, overhead and profit shall not be listed as separate items.

Documentation for progress payments shall be supported by the following documents:

(a) One counterpart of a Work Progress Certificate signed by the Contractor and jointly countersigned by the Owner's Engineer and the Project Manager.

(b) The Contractor shall submit all Work Progress Certificates to both the Owner's Engineer and the Project Manager simultaneously by registered air mail. The Owner's Engineer and the Project Manager will either countersign or reject a Work Progress Certificate within a maximum period of thirty (30) days from the date of receipt of such Certificate by him. If the Owner's Engineer and the Project Manager or either shall fail either to countersign or to reject a Work progress Certificate within the said thirty (30) days period, the Contractor shall notify the Project Manager by cable of the delay in the approval from the Site; and the Project Manager will either countersign the Work Progress Certificate in question or assign his reasons for not doing so within a maximum period of sixty (60) days from the date of receipt of the Contractor's said cable notice to him.

(c) The Contractor shall furnish to the Project Manager and the Owner's Engineer or either whenever called upon to do so any additional information or documents that may be required in connection with verification of progress

claims and or any other payments made.

Appendix 2. Price Adjustment (Not Applicable)

Prices payable to the Contractor, in accordance with the Contract, shall be subject to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula:

The Contract is subject to price adjustment applying the following formulae and the weightings or coefficients :

[*Price Adjustment Formulae to be applicable if stated under ITT Sub Clause 26.9 shall be specified here]*

Example:

P= A + a (Lm/Lo)+ b (BIm/BIo)+ c (CEm/CEo)+ d (RSm/RSo)+ e (STm/STo)+ f (BRm/BRo)+g (MIm/MIo) + h (FUm/FUo)+ etc

where;

L= Labor, BI=Bitumen, CE=Cement, RS=Reinforcing Steel, ST=Stone, BR=Bricks, MI=Miscellaneous, FU= Fuel]

Weighting or Coefficient A equals between 0.10 and 0.15 and, B (a+b+c+d+e+f+g+h+etc) equals between 0.90 and 0.85.

[insert figure] non-adjustable component (**coefficient A**)

[insert figure] adjustable component (**coefficient B**)

*[The sum of **A+B** shall equal **ONE** (1). It is usual to have value of **A** between 0.10 and 0.15 and that of **B** between 0.90 and 0.85. Breakdown of **B**shall be provided in **Appendix to the Tender.]***

[delete as appropriate]

The date of adjustment shall be the mid-point of the period of manufacture or installation of component or Plant.

The following conditions shall apply:

(a) No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.

(c) No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.

For complex plant supply and installation involving several sources of supply and/or a substantial amount of installation works, a family of formulas may be necessary, with provision for the usage of Contractor's equipment in the works formula.

Appendix 3. Insurance Requirements

Insurances To Be Taken Out By The Contractor

In accordance with the provisions of GCC Clause 49, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

The minimum insurance cover shall be 110% (Hundred Ten). The insurance policy would be furnished from Bangladesh Sadharan Bima Corporation.

The Contractor/Supplier shall secure and maintain throughout the duration of the contract insurance of such types and in such amounts as may be necessary to protect himself and the interest of Purchaser against hazards of risk or loss at Supplier's cost. Failure of the Supplier to maintain such coverage shall not relieve him of any contractual responsibility or obligations for transportation and ocean cargo insurance from port of loading to port of unloading and from warehouse to warehouse in Bangladesh.

As Marine/Cargo insurance as well as Local Insurance shall be from Sadharan Bima Corporation, 139, Motijheel Commercial Area, Dhaka, Bangladesh and the cost shall be paid by Supplier/Contractor. Shipment of goods in any chartered vessel over 15(fifteen) years of age and shipment of goods in the Deck are prohibited.

(a) Cargo Insurance

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefore) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount [in currency(ies)]	**Deductible limits** [in currency(ies)]	**Parties insured** [names]	**From** [place]	**To** [place]
Hundred Ten Percent (110%) of Contract Price	----------	BPDB	Supplier's or manufacturer's Works or Stores	Contractor's Store in Bangladesh

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the Site for the purpose of performing its obligations during the defect liability period.

Amount [in currency(ies)]	**Deductible limits** [in currency(ies)]	**Parties insured** [names]	**From** [place]	**To** [place]
Hundred Ten Percent (110%) of Contract Price	-	BPDB		

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property (including the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the Facilities.

Amount [in currency(ies)]	**Deductible limits** [in currency(ies)]	**Parties insured** [names]	**From** [place]	**To** [place]
In accordance statutory requirement				

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors (whether or not owned by them) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurances

The Contractor is also required to take out and maintain at its own cost the following insurances:

Details:

Amount [in currency(ies)]	**Deductible limits** [in currency(ies)]	**Parties insured** [names]	**From** [place]	**To** [place]
Nil	Nil	Nil	Nil	Nil

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause49.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Insurances to be Taken Out By The Employer

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances.

Details:

Amount [in currency(ies)]	**Deductible limits** [in currency(ies)]	**Parties insured** [names]	**From** [place]	**To** [place]
Nil	Nil	Nil	Nil	Nil

Appendix 4. Time Schedule

Time(s) for Completion as stated in the PCC24.1.

Except under exceptional circumstances, the Time Schedule should indicate periods of time (e.g., weeks or months) and not specify calendar dates. All periods should be shown from the Effective Date of the Contract.

The Bidder shall be required to submit with its bid a detailed program, normally in the form of a bar chart & CPM, showing how and the order in which it intends to perform the Contract and showing the key events requiring action or decision by the Employer. In preparing this Program, the Bidder shall adhere to the Time(s) for Completion given in the Bid Data Sheet or give its reasons for not adhering thereto. The Time Schedule submitted by the selected Bidder and amended as necessary prior to award of Contract shall be included as Appendix to the Contract Agreement before the Contract is signed.

If bidders, pursuant to the provisions of the Instructions to Bidders, are to be permitted to offer an Alternative Bid based on a different Time Schedule, details of this and any resulting reduction in Price from their conforming bid based on the Time Schedule included in the bidding documents shall be submitted as an Attachment to their bid.

Appendix 5. List of Major Items of Plant and Services and List of Approved Subcontractors

A list of major items of plant and services is provided below.

The following Subcontractors and/or manufacturers are approved for carrying out the item of the facilities indicated. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with GCC Sub-Clause 32.1, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Employer and their names have been added to this list of Approved Subcontractors.

Major Items of Plant and Services	Approved Subcontractors/Manufacturers	Nationality

Appendix 6. Scope of Works and Supply by the Employer

The following personnel, facilities, works and supplies will be provided/supplied by the Employer, and the provisions of GCC Clauses 25, 36, 39 and 40 shall apply as appropriate.

All personnel, facilities, works and supplies will be provided by the Employer in good time so as not to delay the performance of the Contractor, in accordance with the approved Time Schedule and Program of Performance pursuant to GCC Sub-Clause 31.2.

Unless otherwise indicated, all personnel, facilities, works and supplies will be provided free of charge to the Contractor.

Personnel	Charge to Contractor (if any)
The Employer will provide operating and maintenance personnel under the Contractor's supervision to get them (employer's O & M personnel) acquainted with and to witness the commissioning of the plant & machineries.	No charge to Contractor.

Facilities	Charge to Contractor (if any)
-	-

Works	Charge to Contractor (if any)
Employer will not do any works. If Contractor do not re-instate the Employer's existing facilities (Civil, fencing etc.) Employer will complete it.	Will be deducted from contractor's payment.

Supplies	Charge to Contractor (if any)
The Employer will not generally supply any machinery/Equipment and materials to the Contractor. In the event of any such requirement and subject to availability, the Employer may extend the facilities to use such machinery and materials by the Contractor on rental charge/cost under normal terms and conditions.	The Contractor will be required to pay the amount to be determined by the Employer for such facilities.

Appendix 7. List of Documents for Approval or Review

Pursuant to GCC Sub-Clause 35.3.1, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Engineer in accordance with the requirements of GCC Sub-Clause 31.2 (Program of Performance), the following documents for

(A) Approval

1. Single Line Diagram (SLD) of each Sub-station.
2. Site Layout Plan and arrangement drawings of each Sub-station
3. Detailed soil investigation program where required, soil test report
4. Civil Drawing i.e Architectural, Structural & Foundation drawing of Building; Equipment foundation and other drawings as per Section 6 & 7.
5. Installation drawings, grounding/earthing design, Lightning protection system, lay out of fire protection etc. as per Section 6 & 7.
6. All GTPs, Electrical, Mechanical, Dimensional, Cross-Sectional Drawing, Connection Diagram, General Arrangement Drawing of all equipment as described in Price Schedule, Section 6, 7 & 8.
7. Detail drawing of Gantry Structure, Transformer, VCB, CT, PT, LA, Isolator, Cable, Conductor, supporting steel structures and other equipment as required.
8. Secondary/Control drawing of AIS/GIS Panels, SAS, RTCC, ACDB, DCDB, Battery Charger panel etc.
9. Other drawings/documents as required.
10. As Built Drawings to be submitted immediately after submission of Operational Acceptance Report/ Provisional Acceptance Report.

(B) Review

1. Listing of additional equipment requirements to match design.

The general guideline to EPC for submission of the drawing but not limited to following details:

1. All Legends/symbols should be mentioned in respective page along with a summary page.
2. All equipment's list, model number, product serial number, quantity, country of origin, general name shall be mentioned.
3. Each page of the drawing should contain Employer name with logo, signature & stamp of EPC contractor and Manufacturer along with drawing title, drawing number, page number, Project Name, Contract number along with date and version of the drawing in the bottom right corner.
4. Rating plate of equipment shall be mentioned with dimension, font size and fitted in visible position during normal service and installation. The rating plate shall be engraved, weather-proof and corrosion proof. Description on the rating plate should be given in "legible English letters".
5. In applicable cases, the revised drawing is required to submit even if the drawing is approved.
6. All types of assumption/calculation should be submitted in book binding format along with signature & stamp of EPC contractor. The basis of the calculation should be as per relevant standard (IEC/IEEE/BDS/BS/IS) and such standard should be attached.
7. Any other additional instruction from BPDB.

Appendix 8. Functional Guarantees

1. General

This Appendix sets out

(a) The functional guarantees referred to in GCC Clause 43 (Functional Guarantees)

(b) The preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below

(c) The minimum level of the functional guarantees

(d) The formula for calculation of liquidated damages for failure to attain the functional guarantees.

2. Preconditions

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied: *[List any conditions for the carrying out of the Guarantee Test referred to in GCC Sub-Clause 40.2.*]

Mentioned in Section 7: Technical Specification & Section 8: GTP

3. Functional Guarantees

Performance of Individual equipment and Performance of Complete Sub-Station capacity as per Section 6: Schedule of Employer's Requirements, Section 7 & section 8 will be checked during Guarantee test. The Guarantee Test run/ Performance Test run of each sub-station shall carry out 03 (Three) days at full/available Power Transformer capacity without any trouble. Necessary testing arrangement to carry out the Commissioning, final inspection, Guarantee Test / performance test shall be supplied by the Contractor within the contract price. If any Test is not possible at site than related document during FAT/Routine Test Report cab be used.

BPDB may take over completed portions of the work after at least three (3) weeks of observation to the outcome of the work, prior to completion of the Contract, by written notice to the Contractor.

Appendix 9: Article(s)

Article 1 Contract Documents	Definitions (Reference GCC Clause 1) Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.
Article 2 Contract Price and Terms of Payment	2.1 Contract Price (Reference GCC Clause 56.1) The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of: [. . . *amounts of foreign currency in words* . . .], [. . . *amounts in figures*. . .] as specified in Price Schedule No. 5 (Grand Summary), [. . . *amounts of local currency in words* . . .], [. . . *amounts in figures*. . .], or such other sums as may be determined in accordance with the terms and conditions of the Contract. 2.2 Terms of Payment (Reference GCC Clause 57) The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in the Appendix (Terms and Procedures of Payment) hereto. In the event that the amount payable under Schedule No. 1 is adjusted in accordance with GCC 56.2 or with any of the other terms of the Contract, the Employer shall arrange for the documentary credit to be amended accordingly

Article 3
Effective Date

3.1 Effective Date (Reference GCC Clause 1)

The Effective Date upon which the period until the Time for Completion of the Facilities shall be counted from is the date when all of the following conditions have been fulfilled:

(a) This Contract Agreement has been duly executed for and on behalf of the Employer and the Contractor;

(b) The Contractor has submitted to the Employer the performance security and the advance payment guarantee;

(c) The Employer has paid the Contractor the advance payment

(d) The Contractor has been advised that the documentary credit referred to in Article 2.2 above has been issued in its favor.

Each party shall use its best efforts to fulfill the above conditions for which it is responsible as soon as practicable.

3.2 If the conditions listed under 3.1 are not fulfilled within two (2) months from the date of this Contract notification because of reasons not attributable to the Contractor, the parties shall discuss and agree on an equitable adjustment to the Contract Price and the Time for Completion and/or other relevant conditions of the Contract.

Article 4 Communications	4.1	The address of the Employer for notice purposes, pursuant to GCC 3.1 is: [*Employer's address*].
	4.2	The address of the Contractor for notice purposes, pursuant to GCC 3.1 is: [*Contractor's address*].
Article 5. Appendices	5.1	The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement.
	5.2	Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

Section 5.Tender and Contract Forms

Form	Title
	Tender Forms
PG5A – 1a	Tender Submission Letter for Technical Proposal
PG5A – 1b	Tender Submission Letter for Financial (Price) Proposal
PG5A – 2a	Tenderer Information Sheet
PG5A – 2b	JVCA Partner Information
PG5A – 2c	Subcontractor Information
PG5A – 3	Price Schedule for Plant and Services
PG5A – 4	Technical Proposal
PG5A – 4a	Specification submission & compliance sheet.
PG5A– 5	Manufacturer's Authorisation Letter
PG5A – 6	Bank Guarantee for Tender Security
PG5A – 6a	**Letter of Commitment for Bank's undertaking for Line of Credit (Form PG5A-6a)**
PG5A – 13	Deviation List
	Contract Forms
PG5A – 7	Notification of Award
PG5A – 8	Contract Agreement
PG5A – 9	Bank Guarantee for Performance Security
PG5A– 10	Bank Guarantee for Advance Payment
PG5A– 11	Bank Guarantee for Retention Money Security (Form PG5A-11)
PG5A– 12	Warranty Certificate

Forms PG5A-1a, PG5A-1b to PG5A-6, PG5A-6a and PG5A-13 comprises part of the Tender and should be completed as stated in ITT Clause 24.

Forms PG5A-7 to PG5A-12 and the appendices of the tender comprises part of the Contract as stated in GCC Clause 6.

Tender Submission Letter for Technical offer
(Form PG5A-1a)

[This letter should be completed and signed by the Authorised Signatory preferably on the Letter-Head Pad of the Tenderer and be appended in the technical proposal envelope]

To: *[Contact Person]* *[Name of Procuring Entity]* *[Address of Procuring Entity]*	Date:
Invitation for Tender No:	*[indicate IFT No]*
Tender Package No:	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

We, the undersigned, offer to design, manufacture, test, deliver, install, pre-commission and commission in conformity with the Tender Document, the following Plant and Services, viz:

In signing this letter, and in submitting our Tender, we also confirm that:

(a) our Tender shall be valid for the period stated in the Tender Data Sheet (ITT Sub Clause 30.1) and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(b) a Tender Security is attached in the form of a *[state pay order, bank draft, bank guarantee]* in the amount stated in the Tender Data Sheet (ITT Sub Clause 32) and valid for a period of twenty eight (28) days beyond the Tender validity date;

(c) we have examined and have no reservations to the Tender Document, issued by you on *[insert date];* including Addendum to Tender Document No(s) [*state numbers*] , issued in accordance with the Instructions to Tenderers (ITT Clause 11). *[insert the number and issuing date of each addendum; or delete this sentence if no Addendum has been issued];*

(d) we, including as applicable, any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub Clause 5.1;

(e) we are submitting this Tender as a sole Tenderer in accordance with ITT Sub Clause 38.3

or

we are submitting this Tender as the partners of a JVCA, comprising the following other partners in accordance with ITT Sub Clause 18.1*;*

	Name of Partner	Address of Partner
1		
2		
3		
4		

(f) *we are not a Government owned entity as defined in ITT Sub Clause 5.3 or*

we are a Government owned entity, and we meet the requirements of ITT Sub Clause 5.3;
(delete one of the above as appropriate)

(g) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents in accordance with ITT Sub Clause 5.5;

(h) we, including as applicable any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices in accordance with ITT Sub Clause 5.6;

(i) furthermore, we are aware of ITT Clause 4 concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;

(j) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub Clause 19.1, to the following Subcontractor(s);

Activity or part of the Plant and Services	Name of Subcontractor with Address

(k) we, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Clause 5.7, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information (**Form PG5A-2b**);

(l) we are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall constitute the acceptance of our Tender and shall become a binding Contract between us, until a formal Contract is prepared and executed;

(m) we, including as applicable any JVCA partner, confirm that we do not have a record of insolvency, receivership, bankrupt or being wound up, our business activities were not been suspended, and it was not been the subject of legal proceedings in accordance with ITT Sub Clause 5.8;

(n) we, including as applicable any JVCA partner, confirm that we have fulfilled our obligations to pay taxes and social security contributions applicable under the relevant national laws and regulations of Bangladesh in accordance with ITT Sub Clause 5.9;

(o) we understand that you reserve the right to reject all the Tenders or annul the Tender proceedings, without incurring any liability to Tenderers, in accordance with ITT Clause 59.

Signature:	*[insert signature of authorised representative of the Tenderer]*
Name:	*[insert full name of signatory with National ID Number, if applicable]*
In the capacity of:	*[insert capacity of signatory]*
Duly authorised to sign the Tender for and on behalf of the Tenderer	

*[If there is more than one (1) signatory, or in the case of a JVCA, add other boxes and sign accordingly].***Attachment 1**:

[ITT Sub Clause 38.3]

Written confirmation authorising the above signatory(ies) to commit the Tenderer

[and, if applicable]

Attachment 2:

[ITT Sub Clause 29.2(b)]

Copy of the JVCA Agreement / Letter of Intent to form JVCA with draft proposed Agreement

Tender Submission Letter for Financial offer
(Form PG5A-1b)

[This letter should be completed and signed by the Authorised Signatory preferably on the Letter-Head Pad of the Tenderer and be appended in the financial proposal envelope]

To: Date:

[Contact Person]

[Name of Procuring Entity]

[Address of Procuring Entity]

Invitation for Tender No: *[indicate IFT No]*

Tender Package No: *[indicate Package No]*

This Package is divided into the following Number of Lots *[indicate number of Lot(s)]*

We, the undersigned, offer to design, manufacture, test, deliver, install, precommission and commission in conformity with the Tender Document, the following Plant and Services, viz:

In accordance with ITT Clauses 26 and 27, the following prices and discounts apply to our Tender:

The Tender Price is: (ITT Sub-Clause 26.1)	*[state amount in figures]* *and [state amount in words]*
Plant (including Mandatory Spare Parts) Supplied from abroad	*[state amount in figures]* *and [state amount in words]*
Plant (including Mandatory Spare Parts) supplied from within the Employer's Country	*Taka[state amount in figures]* *And Taka [state amount in words]*
Design Services	*[state amount in figures]* *and [state amount in words]*
Installation and Other Services	*[state amount in figures]* *and [state amount in words]*
Recommended Spare parts Price (If economic Factor is applicable)	*[state amount in figures]* *and [state amount in words]*
The Unconditional discount is (ITT Sub-Clause 26.11)	*[state amount in figures]* *and [state amount in words]*
The methodology for Application of the discount is:	*[state the methodology]*

and we shall accordingly submit an Advance Payment Guarantee in the format shown in Form PG5A- 10.

In signing this letter, and in submitting our Tender, we also confirm that:

a) our Tender shall be valid for the period stated in the Tender Data Sheet (ITT Sub Clause 30.1) and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

b) a Tender Security is attached in the form of a [state pay order, bank draft, bank guarantee] in the amount stated in the Tender Data Sheet (ITT Sub Clause 32) and valid for a period of twenty eight (28) days beyond the Tender validity date;

c) if our Tender is accepted, we commit to furnishing a Performance Security within the time stated under ITT Sub Clause 65.1) and in the form specified in the Tender Data Sheet (ITT Sub Clause 66.1) valid for a period of twenty eight (28) days beyond the date of issue of the Completion Certificate of the Plants and Services;

d) we have examined and have no reservations to the Tender Document, issued by you on [insert date]; including Addendum to Tender Document No(s) [state numbers] , issued in accordance with the Instructions to Tenderers (ITT Clause 11). [insert the number and issuing date of each addendum; or delete this sentence if no Addendum has been issued];

e) we, including as applicable, any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub Clause 5.1;

f) we are submitting this Tender as a sole Tenderer in accordance with ITT Sub Clause 38.3 or
we are submitting this Tender as the partners of a JVCA, comprising the following other partners in accordance with ITT Sub Clause 18.1*;*

	Name of Partner	Address of Partner
1		
2		
3		
4		

g) we are not a Government owned entity as defined in ITT Sub Clause 5.3 or

we are a Government owned entity, and we meet the requirements of ITT Sub Clause 5.3;

(delete one of the above as appropriate)

h) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents in accordance with ITT Sub Clause 5.5;

i) we, including as applicable any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices in accordance with ITT Sub Clause 5.6;

j) furthermore, we are aware of ITT Clause 4 concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;

k) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub Clause 19.1, to the following Subcontractor(s);

Activity or part of the Plant and Services	Name of Subcontractor with Address

l) we, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Clause 5.7, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information **(Form PG5A-2b);**

m) we are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall constitute the acceptance of our Tender and shall become a binding Contract between us, until a formal Contract is prepared and executed;

n) we, including as applicable any JVCA partner, confirm that we do not have a record of insolvency, receivership, bankrupt or being wound up, our business activities were not been suspended, and it was not been the subject of legal proceedings in accordance with ITT Sub Clause 5.8;

o) we, including as applicable any JVCA partner, confirm that we have fulfilled our obligations to pay taxes and social security contributions applicable under the relevant national laws and regulations of Bangladesh in accordance with ITT Sub Clause 5.9;

p) we understand that you reserve the right to reject all the Tenders or annul the Tender proceedings, without incurring any liability to Tenderers, in accordance with ITT Clause 61

Signature:	*[insert signature of authorised representative of the Tenderer]*
Name:	*[insert full name of signatory with National ID Number]*
In the capacity of:	*[insert capacity of signatory]*
Duly authorised to sign the Tender for and on behalf of the Tenderer	

*[If there is more than one (1) signatory, or in the case of a JVCA, add other boxes and sign accordingly].***Attachment 1**:
[ITT Sub Clause 38.3]
Written confirmation authorising the above signatory(ies) to commit the Tenderer

[and, if applicable]

Attachment 2:
[ITT Sub Clause 29.2(b)]
Copy of the JVCA Agreement / Letter of Intent to form JVCA with draft proposed Agreement

Tenderer Information (Form PG5A-2a)

[This Form should be completed only by the Tenderer, preferably on its Letter-Head Pad]

Invitation for Tender No: *[indicate IFT No]*

Tender Package No: *[indicate Package No]*

This Package is divided into the following Number of Lots: *[indicate number of Lot(s)]*

1.	Eligibility Information of the Tenderer [ITT –Clauses 5 & 29]				
1.1	Nationality of individual or country of registration				
1.2	Tenderer's legal title				
1.3	Tenderer's registered address				
1.4	Tenderer's legal status *[complete the relevant box]*				
	Proprietorship				
	Partnership				
	Limited Liability Concern				
	Government-owned Enterprise				
	Others [please describe, if applicable]				
1.5	Tenderer's year of registration				
1.6	Tenderer's authorised representative details				
	Name				
	National ID number				
	Address				
	Telephone / Fax numbers				
	e-mail address				
1.7	Litigation [ITT Cause 13]				
	If there is no history of litigation or no pending litigation then state opposite "None". If there is a history of litigation, or a number of awards, against the Tenderer provide details below				
	A. Arbitration Awards made against				
	ar	Matter in dispute	Value of Award	Value of Claim	

	B. **Arbitration Awards pending**		
	Year	Matter in dispute	Value of Claim
1.8	Tenderer to attach photocopies of the original documents mentioned aside	[All documents required under ITT Clauses 5 and 29]	
The following two information are applicable for National Tenderers			
1.9	Tenderer's Value Added Tax Registration (VAT) Number		
1.10	Tenderer's Tax Identification Number(TIN)		
[The foreign Tenderers, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]			

2. Qualification Information of the Tenderer [ITT Clause 29]					
2.1 General Experience in Plant and Services of Tenderer					
	Start Month Year	End Month Year	Years	Contract No and Name of Contract Name and Address of Procuring Entity Brief description of Plant and Services	Role of Tenderer [Contractor/Subcontractor /Management Contractor]

2.2	Specific Experience in Key Activities			
	Contract No Name of Contract	[insert reference no] of [insert year] [insert name]		
	Role in Contract *[tick relevant box].*	Contractor	Subcontractor	Management Contractor
	\Award date Completion date Total Contract Value	[insert date] [insert date] [insert amount]		
	Procuring Entity's Name Address Tel / Fax e-mail Brief description with justifications of the similarity compared to the Procuring Entity's requirements	[state justification in support of its similarity compared to the proposed works]		

2.3	Average annual turnover [ITT Sub Clause15.1(a)] *[amount invoiced to Procuring Entity(s) for each year of works in progress or completed, using rate of exchange at the end of the period reported]*		
	Year	Amount & Currency	*amount in figures*
2.4	Financial Resources available to meet the cash flow [ITT Sub Clause 15.1(b)]		
	No	Source of Financing	Amount Available
	In order to confirm the above statements the Tenderer shall submit , as applicable, the documents mentioned in ITT Sub Clause 14.1(a), (b) and 15.1 (a), (b) & (c)		
2.5	Contact Details		
	Name, address, and other contact details of Tenderer Bankers and other Procuring Entity(s) that may provide references, if contacted by this Procuring Entity		
2.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 16.1]		
	Position Name Years of General Experience	Years of Specific Experience	
	[*Tenderer to complete details of as many personnel as are applicable.Each personnel listed above should complete the Personnel Information (Form PG5A-5*)]		
2.7	Major Equipment proposed to carry out the Contract [ITT Sub Clause 17.1]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, less or seller)

[Tenderer to list details of each item of major equipment, as applicable]			

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Annexure: 5-1 Tenderer's Completed Turnkey Contracts
Annexure: 5-2 Tenderer's Ongoing Turnkey Contract(s)
Annexure: 5-3 Financial Requirements for Ongoing Turnkey Contract(s) Commitments
Annexure: 5-4 Assessment of Financial Resources Availability

JVCA Partner Information (Form PG5A-2b)

[This Form should be completed by each JVCA partner].

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

1.	Eligibility Information of the JVCA Partner [*ITT –Clauses 5 & 29]*			
1.1	Nationality of Individual or country of Registration			
1.2	JVCA Partner's legal title			
1.3	JVCA Partner's registered address			
1.4	JVCA Partner's legal status *[complete the relevant box]*			
	Proprietorship			
	Partnership			
	Limited Liability Concern			
	Government-owned Enterprise			
	Other (please describe, if applicable)			
1.5	JVCA Partner's year of registration			
1.6	JVCA Partner's authorised representative details			
	Name			
	National ID number			
	Address			
	Telephone / Fax numbers			
	e-mail address			
1.7	Litigation [ITT Sub Cause 13]			
	If there is no history of litigation or no pending litigation then state "None". If there is a history of litigation, or a number of awards, against the JVCA Partner provide details below:			
	A. Arbitration Awards made against			
	Year	Matter in dispute	Value of Award	Value of Claim
	B. Arbitration Awards pending			
	Year	Matter in dispute	Value of Claim	

1.8	JVCA Partner to attach copies of the original documents mentioned aside	[All documents required under ITT Clauses 5 and 29]	
The following two information are applicable for national JVCA Partners only			
1.9	JVCA Partner's Value Added Tax Registration (VAT) Number		
1.10	JVCA Partner's Tax Identification Number (TIN)		
	[The foreign JVCA Partners, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]		

	2. Key Activity(ies) for which it is intended to be joint ventured [ITT Sub Clause 18.2 & 18.3]	
	Elements of Activity	Brief description of Activity

3.	Qualification Information of the JVCA Partner [ITT Clause 18]				
3.1	General Experience in Plant and Services of JVCA Partner				
	Start Month Year	End Month Year	Years	Contract No and & Name of Contract Name and Address of Procuring Entity Brief description of Works	Role of JVCA Partner [Contractor/Subcontractor/Management Contractor]

3.2	Specific Experience in Key Activities			
	Contract No Name of Contract	[insert reference no] of [insert year] [insert name]		
	Role in Contract [tick relevant box]	Contractor	Subcontractor	Management Contractor
	Award date Completion date Total Contract Amount	[insert date] [insert date] [insert amount]		
	Procuring Entity's Name Address Tel / Fax e-mail	[state justification in support of its similarity compared to the proposed plants and service] Brief description with justifications of the similarity compared to the Procuring Entity's requirements		

3.3	Average annual construction turnover [ITT Sub Clause 15.1 (a)] *[amount invoiced to Procuring Entity(s) for each year of work in progress or completed, using rate of exchange at the end of the period reported]*		
	Year	Amount & Currency	Amount in Figures
3.4	Financial Resources available to meet the cash flow [ITT Sub-Clause 15.1(b)]		
		Source of financing	Amount available
	In order to confirm the above statements the JVCA Partner shall submit , as applicable, the documents mentioned in ITT Sub Clause 14.1 (a) & (b)15.1 (a), (b), (c) & (d)		
3.5	Contact Details		
	Name, address, and contact details of Tenderer's Bankers and other Procuring Entity(s) that may provide references if contacted by this Procuring Entity		
3.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 16.1]		
	Position Name Years of General Experience	Years of Specific Experience	
	[Tenderer to complete details of as many personnel as are applicable. Each personnel listed above should complete the Personnel Information (Form PG5A-5)]		
3.7	Major items of Construction Equipment proposed for carrying out the works [ITT Sub-Clause 17.1]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, leaser or seller)
[Tenderer to list details of each item of Major equipment, as applicable]			

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Annexure: 5-1 Tenderer's Completed Turnkey Contracts
Annexure: 5-2 Tenderer's Ongoing Turnkey Contract(s)
Annexure: 5-3 Financial Requirements for Ongoing Turnkey Contract(s) Commitments
Annexure: 5-4 Assessment of Financial Resources Availability

Annexure: 5-1

Tenderer's Completed Turnkey Contracts (within last ten years):

Sl. No.	Name, Address, Phone No., Fax No. & domain E-mail of the Employer	Contract No. & Date	Description of Work	Contract Value	Date of completion
1.					
2.					
3.					
4.					

I/We hereby declare that, above mentioned information* is correct and there are no more completed turnkey contracts in Government entities under power sector of Bangladesh other than those mentioned in the above table.

Signatory Name:
Designation:

Seal & Signature
of the Tenderer

Note:** This information shall have to be mentioned in the Letterhead pad of the Tenderer (in case of JVCA, Lead partner) duly seal & signed along with supporting document. **Failure to submit or misrepresentation of the detail information for any completed turnkey contract, Tender shall be rejected without further evaluation.

Annexure: 5-2

Tenderer's Ongoing Turnkey Contract(s):

Sl. No.	Name, Address, Phone No., Fax No. & domain E-mail of the Employer	Contract /NOA No. & Date	Description of Work	Contract Value V_o	Completion of work in Percentage	Value of Completed Work V_c	Outstanding Contract Value[1] $V = (V_o - V_c) * X\%$	Date of completion	
								As per Contract	Target
1.									
2.									
3.									
4.									

I/We hereby declare that, above mentioned information[2] is correct and there are no more ongoing turnkey contracts in Government entities under power sector of Bangladesh other than those mentioned in the above table.

Signatory Name:
Designation:

Seal & Signature
of the Tenderer

Note:

1. *If Ongoing Contract(s) are being implementing by Single entity, then "X" will be 100%. On the other hand If Ongoing Contract(s) are being implementing by JVCA, then the Outstanding Contract Value shall be in accordance with the share in percentage (%) of the Ongoing JVCA Contract(s), in that case "X" will be the percentage of share. [JVCA agreement for the Ongoing Contract(s) shall have to be submitted].*
2. *This information shall have to be mentioned in the Letterhead pad of the Tenderer (in case of JVCA, each partner shall have to submit above information separately) duly seal & signed along with supporting document.*
3. ***Failure to submit or misrepresentation of the detail information for any ongoing turnkey contract, Tender shall be rejected without further evaluation.***

Annexure: 5-3

Financial Requirements for Ongoing Turnkey Contract(s) Commitments:

Sl. No.	Name, Address, Phone No., Fax No. & domain E-mail of the Employer	Contract /NOA No. & Date	Description of Work	Contract Value	Outstanding Contract Value (V) [a]	Remaining Contract Period in months (Y) [b]	Monthly Financial Resources Requirement (V / Y)
1.							
2.							
3.							
4.							
Total Monthly Financial Requirement for Ongoing Turnkey Contract(s) Commitments							

[a] Remaining outstanding contract values to be forwarded from Annexure 5-2 and calculated from 28 days prior to the Tender submission deadline of this Tender.

[b] Remaining contract period to be calculated from 28 days prior to the Tender submission deadline of this Tender.

I/We hereby declare that, above mentioned information[2] is correct and there are no more ongoing turnkey contracts in Government entities under power sector of Bangladesh other than those mentioned in the above table.

Signatory Name:
Designation:

Seal & Signature
of the Tenderer

Note: This information shall have to be mentioned in the Letterhead pad of the Tenderer (in case of JVCA, each partner shall have to submit above information separately) duly seal & signed. ***Failure to submit or misrepresentation of this information for any ongoing turnkey contract, Tender shall be rejected without further evaluation.***

Annexure: 5-4

Assessment of Financial Resources Availability:

Table- 4A: For Single Entities					
Total Available Financial Resources from Tenderer Information (Form PG5A-2a) Sl. No. 2.4 (A)	Total Monthly Financial Requirement for Ongoing Turnkey Contracts Commitments from Annexure: 5-3 (B)	Financial Requirement of Ongoing Turnkey Contracts Commitments for 2(two) months C= (2*B)	Net amount Available Financial Resources D= (A-C)	Financial Requirement for this Tender (E)	Results: [D must be greater than or equal to E] (F*)
				60 (Sixty) Crore or equivalent USD 7 (Seven) million]	

Note: * "F" Must be satisfied to qualify the Tenderer for this Tender.

Table- 4B: For Joint Venture, Consortium or Association (JVCA)						
JVCA Partners	Total Available Financial Resources from JVCA Partner Information (Form PG5A-2b) Sl. No. 3.4 (A)	Total Monthly Financial Requirement for Ongoing Turnkey Contracts Commitments from Annexure: 5-3 (B)	Financial Requirement of Ongoing Turnkey Contracts Commitments for 2(two) months C= (2*B)	Net amount Available Financial Resources D= (A-C)	Financial Requirement for this Tender (E)	Results: [∑D must be greater than or equal to E] (F*)
Partner- 1 (Lead)					60 (Sixty) Crore or equivalent USD 7 (Seven) million]	
Partner- 2 (Others)						
Partner- 3 (Others)						
.....						
Partner- n (Others)						
All Partners Combined						

Note: * "F" Must be satisfied to qualify the Tenderer for this Tender.

Subcontractor Information (Form PG5A-2c)

[This Form should be completed by each Subcontractor, preferably on its Letter-Head Pad]

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

1. Eligibility Information of the Subcontractor [*ITT –Clauses 5 & 29]*		
1.1	Nationality of Individual or country of Registration	
1.2	Subcontractor's legal title	
1.3	Subcontractor's registered address	
1.4	Subcontractor's legal status *[complete the relevant box*	
	Proprietorship	
	Partnership	
	Limited Liability Concern	
	Government-owned Enterprise	
	Other (please describe)	
.1.5	Subcontractor's year of registration	
1.6	Subcontractor's authorised representative details	
	Name	
	Address	
	Telephone / Fax numbers	
	e-mail address	
1.7	Subcontractor to attach copies of the following original documents	All documents to the extent relevant to ITT Clause 5 and 29 in support of its qualifications
The following two information are applicable for national Subcontractors		
1.8	Subcontractor's Value Added Tax Registration (VAT) Number	
1.9	Subcontractor's Tax Identification Number(TIN)	
[The foreign Subcontractors , in accordance with ITT sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]		
2. Key Activity(ies) for which it is intended to be Subcontracted [ITT Sub Clause 19.1]		

2.1	Elements of Activity	Brief description of Activity
2.2	List of Similar Contracts in which the proposed Subcontractor had been engaged	
	Name of Contract and Year of Execution	
	Value of Contract	
	Name of Procuring Entity	
	Contact Person and contact details	
	Type of Assignment performed	
Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Price Schedule for Plant and Service (Form PG5A-3)

(This form should be completed and submitted by the tenderer and appended in the financial proposal envelope)

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

General

1. The Price Schedules are divided into separate Schedules as follows:

   Schedule No. 1: Plant (including Mandatory Spare Parts) Supplied from Abroad

   Schedule No. 2: Plant (including Mandatory Spare Parts) Supplied from within the Employer's Country

   Schedule No. 3: Design Services

   Schedule No. 4: Civil Works part

   Schedule No. 5: Installation and Other Services

   Schedule No. 6: Grand Summary

   Schedule No. 7: Recommended Spare Parts

2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Tenderers shall be deemed to have read the Employer's Requirements and other sections of the Tender Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

3. If tenderers are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITT 9.1 prior to submitting their tender.

Pricing

4. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Tenderer.

   As specified in the Tender Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.

5. Tender prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Tenderers in the Tender Document.

   For each item, tenderers shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.

   Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements) or elsewhere in the Tender Document.

6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.

7. When requested by the Employer for the purposes of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Schedules of Rates and Prices

Schedule No. 1 - Plant and Mandatory Spare Parts Supplied from Abroad

1. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .		Set	1				
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-5Set (1 set =03 Nos).		Lot	1				
3	Supply of 11 kV indoor Gas Insulated Switchgear		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	(GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.							
	GIS cubicles Incoming Feeders (2500A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.							
	GIS cubicles Outgoing Feeders (630 A) -12Nos.							
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel with complete acessories.		Set	2				
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking Provision including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .		Set	1				
	b)Supply of DC Distribution Panel including all accessories.		Set	1				
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter. Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.		Lot	1				
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 300 meter.		Lot	1				
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required.		Lot	1				
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.		Lot	1				
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.		Lot	1				
14	Supply of All Control cables of different sizes and		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.							
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.							
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.		Lot	1				
16	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	14				
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.		Lot	1				
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.		Lot	1				
19	Outdoor and Indoor Lighting System.		Lot	1				
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
Column 6 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

2. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone .		Set	1				
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 5Set (1 set =03 Nos).		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.		Set	1				
	GIS cubicles Incoming Feeders (2500A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.							
	GIS cubicles Outgoing Feeders (630 A) -12Nos.							
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.		Set	2				
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories.		Set	1				
	b) Supply of DC Distribution Panel including all accessories.		Set	1				
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter.		Lot	1				
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 300 meter.		Lot	1				
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required		Lot	1				
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.		Lot	1				
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.		Lot	1				
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.		Lot	1				
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	14				
17	Substation Automation System (SAS) including all accessories.		Lot	1				
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.		Lot	1				
19	Outdoor and Indoor Lighting System.		Lot	1				
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter,		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	Supporting Steel Structure and other accessories etc.) of Equipment as applicable.							
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
	Column 6 to be carried forward to Schedule No. 6. Grand Summary							

Note:*1. *Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

3. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .		Set	1				
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-4 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 9Set (1 set =03 Nos).		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.		Set	1				
	GIS cubicles Incoming Feeders (2500A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.							
	GIS cubicles Outgoing Feeders (630 A) -8Nos.							
4	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
5	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				
6	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
7	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .		Set	1				
	b) Supply of DC Distribution Panel including all accessories.		Set	1				
8	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter. Supply of 33kV 1C×800sq.mm XLPE (Cu) Cable as required for Incoming Feeder. As per field requirement but not less than 480 meter. Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 960 meter.		Lot	1				
9	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 420 meter.		Lot	1				
10	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required		Lot	1				
11	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 640 meter.		Lot	1				
12	Supply of all Cable termination kits in line with BOQ		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	(For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.							
13	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.		Lot	1				
14	Supply of all material for Grounding System, Earthing mesh with earthling electrode.		Lot	1				
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
15	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	10				
16	Substation Automation System (SAS) including all accessories.		Lot	1				
17	Supply of split type Air conditioner, 48,000 BTU/hour capacity but not limited to.		Lot	1				
18	Outdoor and Indoor Lighting System.		Lot	1				
19	All Steel Supporting Structures (including EM		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.							
20	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
	Column 6 to be carried forward to Schedule No. 6. Grand Summary							

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

4. Name of the Work: **Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.** **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone.		Set	1				
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 7 Set (1 set =03 Nos).		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -12Nos.		Set	1				
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.		Set	2				
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.		Set	1				
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .		Set	1				
	b) Supply of DC Distribution Panel including all accessories.		Set	1				
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210meter.		Lot	1				
	Supply of 1C×800sq. mm XLPE (Cu) Cable for 33kV Incoming feeder as per requirement. As per field requirement but not less than 480 meter.							
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 480 meter.		Lot	1				
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required		Lot	1				
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	less than 960 meter.							
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.		Lot	1				
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.		Lot	1				
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.							
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.		Lot	1				
16	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	14				
17	Substation Automation System (SAS) including all accessories.		Lot	1				
18	Supply of split type Air conditioner,48,000		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	BTU/hour capacity but not limited to.							
19	Outdoor and Indoor Lighting System.		Lot	1				
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.		Lot	1				
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
Column 6 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

5. Name of the Work: **Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.** **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone . GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos. GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No. GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos. GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		Set	1				
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-7Set (1 set =03 Nos).		Lot	1				
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -12Nos.							
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer (Outdoor type) with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.		Set	2				
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .		Set	1				
	b) Supply of DC Distribution Panel including all accessories.							
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210meter.		Lot	1				
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 420 meter.		Lot	1				
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required		Lot	1				
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.		Lot	1				
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	indoor and outdoor) including all accessories.							
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.		Lot	1				
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.		Lot	1				
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	14				
17	Substation Automation System (SAS) including all accessories.		Lot	1				
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.		Lot	1				
19	Outdoor and Indoor Lighting System.		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.		Lot	1				
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
Column 6 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

6. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone . GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos. GIS cubicles Outgoing Feeders (1250A) with PT-5 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -2 No. GIS cubicles Power Transformer Feeders (1250A) with PT-3 Nos. GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		Set	1				
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-11 Set (1 set =03 Nos).		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-3 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-2 No. GIS cubicles Outgoing Feeders (630 A) -18Nos.		Set	1				
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.		Set	3				
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .		Set	1				
	b) Supply of DC Distribution Panel including all accessories.		Set	1				
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter. Supply of 3X1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 1200 meter.		Lot	1				
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 420 meter.		Lot	1				
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required		Lot	1				
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 1440 meter.		Lot	1				
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	indoor and outdoor) including all accessories.							
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.		Lot	1				
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.		Lot	1				
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	21				
17	Substation Automation System (SAS) including all accessories.		Lot	1				
18	Supply of split type Air conditioner 48,000 BTU/hour capacity but not limited to.		Lot	1				
19	Outdoor and Indoor Lighting System.		Lot	1				
20	All Steel Supporting Structures (including EM		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.							
21	Supply of Fire Detection & Fire Fighting Equipment with Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
Column 6 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

07. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 3150 Ampere Double Bus,, GIS cubicles for 1 Bus Sectionaliser (3150A), 2 sets of 33 kV Bus PTs and 33 kV Isolators, Lightning Arrestors and other related accessories as needed along with 33 kV Control, Protection and Metering system housed in the same 33 kV GIS panels and 17 Circuit Breakers (1250A) . All the Circuit Breaker's control with Local/ Remote switch metering and status data shall be brought under Substation Automation System and interfaced with the existing BPDB's SCADA system in Chattogram but not limited to. GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos. GIS cubicles Outgoing Feeders (1250A) with PT-17 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (3150 A) -1 No. GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos. GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		Set	1				
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-20 Set (1 set =03 Nos).		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -10Nos.		Set	1				
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.		Set	2				
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories		Set	1				
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories		Set	1				
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and		Set	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .		Set	1				
	b) Supply of DC Distribution Panel including all accessories.							
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter. Supply of 1C×800sq. mm XLPE (Cu) Cable for 33kV incoming feeder as per requirement. As per field requirement but not less than 1440 meter. Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 4080 meter.		Lot	1				
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 300 meter.		Lot	1				
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required		Lot	1				
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	less than 800 meter.							
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.		Lot	1				
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.		Lot	1				
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.		Lot	1				
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.		Set (1 set =03 Nos)	12				
17	Substation Automation System (SAS) including all accessories.		Lot	1				
18	Supply of split type Air conditioner,48,000		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	BTU/hour capacity but not limited to.							
19	Outdoor and Indoor Lighting System.		Lot	1				
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.		Lot	1				
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets		Lot	1				
Column 6 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

08. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone . GIS cubicles Incoming Feeders (2000A) with PT- 1 Nos. GIS cubicles Outgoing Feeders (1600A) with PT-4 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		Set	1				
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 4 Set (1 set =03 Nos).		Lot	1				
3	Supply of 33kV 3x1C×800 sq.mm XLPE (Cu) Cable as required for Incoming Feeder. As per field requirement but not less than 720 meter.		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
4	All Cable termination kits (33 kV) for 800 sq. mm XLPE (Cu) Cable both sides along with all accessories and cable support structure for incoming and outgoing feeders.		Lot	1				
5	Control Cables including CT and PT cables and LV Power Cables with all accessories between Control Room panels and 33 kV switchyard equipment.		Lot	1				
6	All material for grounding connection of individual equipment with substation/ earthing mesh, 185 mm² grounding copper conductor, suitable connector and earthling electrode as required to achieve Earth Resistance as per standard.		Lot	1				
7	Substation Automation System (SAS) including all accessories.		Lot	1				
8	Supply of split type Air conditioner, 48,000 BTU/hour capacity but not limited to.		Lot	1				
9	Outdoor and indoor Lighting System with energy saving lamps etc.		Lot	1				

Line Item No	Description of Item	Country of Origin	Quantity	Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4	5	6 = 4 x 5	7
Column 6 to be carried forward to Schedule No. 6. Grand Summary						

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

09. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram... **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency	Total Price (Foreign Currency or Taka)
1	2	3	4		5	6	7 = 5X6	8
1	33 kV Vacuum Circuit Breaker, 1600 A, 25 kA for 3 sec. outdoor type along with all supporting structure and all accessories.		Set	2				
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with all supporting structure and all accessories. 2 Sets(1 set=3 nos)		Lot	1				
3	33 kV Isolator 1600A, 25 kA for 3 sec. without earthling blade gang operated vertical mounted vertical break with galvanized steel support structure and necessary connectors and all accessories. 2 Sets(1 set=3 nos)		Lot	1				
4	33 kV line isolator 1600A, 25 kA for 3 sec. with earthling blade gang operated vertical mounted vertical break with galvanized steel support structure and necessary connectors and all accessories. 2 Sets(1 set=3 nos)		Set	1				
5	33 kV 3 × single phase Current Transformer (3 nos. per circuit) outdoor type ratio 800-1600/5/5A class 5P10 for protection and 0.2 for measuring along with supporting steel structure and suitable bi-metallic connectors and accessories as per field requirement.		Set	2				

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency	Total Price (Foreign Currency or Taka)
1	2	3	4		5	6	7 = 5X6	8
6	Suitable busbar Droppers, Conductors, Connectors, outdoor marshal kiosk, hardware clamps, nuts and bolts, etc. as required for connecting the individual items of equipment of 33 kV switchyard & complete bay extension.		Lot	1				
7	PG Clamps including all other Clamps as Required		Lot	1				
8	33 kV Disc Insulator set with necessary suitable front and back connecting clamps.		Lot	1				
09	33 kV control, metering and protection panel for 33 kV line feeder with 2 O/C, 1 E/F (IDMT and Ins). 2 Directional O/C + 1 Directional E/F relays including audio visual annunciator and all accessories		Lot	1				
10	All Control Cables including CT and PT cables and LV Power Cables with all accessories between Control Room panels and 33kV switchyard equipment.		Lot	1				
11	All material for grounding connection of individual equipment with substation mesh, 185 mm² grounding copper conductor, suitable connector and earthling electrode as required to achieve Earth Resistance as per standard and all accessories.		Lot	1				
	TOTAL Column 5 to be carried forward to Schedule No. 6. Grand Summary							

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

10. Name of the Work: Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to chawk bazar 33/11 kV Substation BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency	Total Price (Foreign Currency or Taka)
1	2	3	4		5	6	7 = 5X6	8
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....		KM	31.35				
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories		Sets	60				
3	33KV Cable Outdoor termination Complete kit.....		Sets	0				
4	Ø150 mm MPP Pipe		Meter	3120				
5	Plastic Cable ties		Sets	2327				
6	24 Core optical fiber including Silicon tube, Galvanised steel pipe.		KM	10.45				
7	Optical fiber cable termination equipment exclusive of all accessories.		Sets	2				
8	Ø40 mm HDPE Pipe		Meter	10450				
9	Ø63 mm PVC Pipe.		Meter	1320				
10	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.		Sets	2				
TOTAL Column 5 to be carried forward to Schedule No. 6. Grand Summary								

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date*

		and Seal
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

11. **Name of the Work:** Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)**

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency	Total Price (Foreign Currency or Taka)
1	2	3	4		5	6	7 = 5X6	8
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....		KM	29.70				
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories		Sets	60				
3	Ø150 mm MPP Pipe for Road crossing, Culvert/Bridge and Railway level crossing		Meter	2760				
4	Best quality of Plastic Cable ties		Sets	2227				
5	24 Core optical fiber including Silicon tube, Galvanised steel pipe.		KM	9.90				
6	Optical fiber cable joint box all accessories.		Lot	0				
7	Optical fiber cable termination equipment exclusive of all accessories.		Sets	2				
8	Ø40 mm HDPE Pipe		Meter	9900				
9	Ø63 mm PVC Pipe.		Meter	1200				
10	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.		Sets	2				
TOTAL Column 5 to be carried forward to Schedule No. 6. Grand Summary								

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

12. Name of the Work: **Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Khulsi Stadium rising Pole Grid to Stadium 33/11 kV Substation BPDB, Chattogram.** (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency	Total Price (Foreign Currency or Taka)
1	2	3	4		5	6	7 = 5X6	8
1	33 KV 1x 800mm² XLPE Armoured Copper Cable.....	KM	1.65	1.65				
2	33KV Cable Outdoor termination Complete kits.....	Sets	6	6				
3	33KV Cable Indoor GIS termination Complete kits.....	Sets	6	6				
4	Clamp, Cable holder in S/S Side..as required	Sets	6	6				
5	200 mm HDPE Pipe	Meter	60	1				
6	15M SPC D Type Pole		Nos	2				
7	33kv Tension type Cross arm		Sets	2				
8	Double Stud clamp with Nuts and Bolts as required		Nos	8				
9	3 Meter M.S. Channel with Nuts and Bolts as required		Sets	2				
10	33KV Disc Insulator With Tension Clamp		Sets	6				
11	Cable cleat clamp with Nuts & Bolt		Sets	700				
	TOTAL Column 5 to be carried forward to Schedule No. 6. Grand Summary							

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***

[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

13. Name of the Work: Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)

Line Item No	Description of Item	Country of Origin	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]	CIP price per Line Item [FC]	Taxes and Duties In Local Currency	Total Price (Foreign Currency or Taka)
1	2	3	4		5	6	7 = 5X6	8
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....		KM	23.10				
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories		Sets	48				
3	Ø150 mm MPP Pipe		Meter	1200				
4	Plastic Cable ties		Sets	1694				
5	24 Core optical fiber including Silicon tube, Galvanised steel pipe.		KM	7.70				
6	Optical fiber cable joint box all accessories.		Lot	0				
7	Optical fiber cable termination equipment exclusive of all accessories.		Sets	2				
8	Ø40 mm HDPE Pipe		Meter	7700				
9	Ø63 mm PVC Pipe.		Meter	240				
10	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.		Sets	2				
	TOTAL Column 5 to be carried forward to Schedule No. 6. Grand Summary							

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

1. **14. Name of the Work: Mandatory Spare parts**

Line Item No	Description of Item	Country of Origin *[Ref. as per ITT 6.3]*	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of HT Bushing for 20/26MVA Power Transformer (1 Set = 3 Nos.)		Sets	2				
2	Supply of LT Bushing for 20/26MVA Power Transformer (1 Set = 4 Nos.)		Sets	2				
3	Supply of 33kV, Single phase Post type Lightning Arrester (ZnO-type), Class-3		Sets (3 nos.= 1 set)	5				
4	Supply of 11kV, Single phase Post type Lightning Arrester (ZnO-type), Class-2		Sets (3 nos.= 1 set)	10				
5	Supply of Closing Coil for GIS panel		Sets	10				
6	Supply of Tripping Coil for GIS panel		Sets	10				
7	Supply of Universal Motor/Spring Charge motor for 11kV GIS panel		Sets	5				
8	Supply of Universal Motor/Spring Charge motor for 33kV GIS panel		Sets	5				
9	Supply of Differential Relay, 3 O/C + 1 E/F + 3 Directional O/C + 1 Directional E/F for 33kV Control Metering and Relay Panel as per technical specification.		Sets	2				
10	Supply of Bay Control and Protection Unit (BCPU), 3 Over Current + 2 Earth fault (1 E/F + 1 Separate Standby Earth Fault) + Directional O/C & E/F relay for 33kV Control Metering and Relay Panel as per		Sets	2				

Line Item No	Description of Item	Country of Origin *[Ref. as per ITT 6.3]*	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	technical specification.							
11	Supply of Bay Control and Protection Unit (BCPU), 3 Over Current + 2 Earth fault (1 E/F + 1 Separate Standby Earth Fault) + Directional O/C & E/F relay for 11kV Control Metering and Relay Panel as per technical specification.		Sets	5				
12	Supply of Heat shrinkable Straight through Jointing kits for 33kV, 800mm^2 Cable including all accessories		Sets	30				
13	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 33kV, 800mm^2 Cable		Sets	12				
14	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 33kV, 500mm^2 Cable		Sets	6				
15	Supply of Heat shrinkable Outdoor termination kit including all accessories for 33kV, 500mm^2 Cable		Sets	6				
16	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 11kV, 630mm^2 Cable		Sets	6				
17	Supply of Heat shrinkable Outdoor termination kit including all accessories for 11kV, 630mm^2 Cable		Sets	6				
18	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 11kV, 3x185mm^2 Cable		Sets	30				
19	Supply of Heat shrinkable Outdoor termination kit including all accessories for 11kV, 3x185mm^2		Sets	30				

Line Item No	Description of Item	Country of Origin *[Ref. as per ITT 6.3]*	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
	Cable							
20	Supply of Tool box for HV Cable Jointing and Termination		Set	2				
21	Supply of Test plug for Power Cable		Sets	2				
22	Supply of SFRA Testing Kit with all accessories and Software		Sets	2				
23	Supply of Cable fault locator with all accessories (EU/UK/USA/Korea/Japan/Australia make)		Sets	2				
24	Supply of Partial Discharge Measurement and Analysis of Transformer & Cable		Sets	2				
25	DS/ES Motor Control Unit/ Device/ Card for 33kV		sets	5				
26	DS/ES Motor Control Unit/ Device/ Card for 11kV		sets	5				
		Column 6 to be carried forward to Schedule No. 6. Grand Summary						

*Note:*1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.***
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6,7&8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

Country of Origin [Ref. as per ITT 6.3] Declaration Form

Item	Description	Country	Place of Manufacture	Item	Description	Country	Place of Manufacture
1	33 kV, 11 kV GIS Indoor Switchgear			13	Earthing mesh with earthing electrode		
2	33/11 kV 5/6.67 MVA ONAN/ONAF Transformer complete with accessories			14	Steel Structure		
3	33/11 kV 10/13.33 MVA ONAN/ONAF Transformer complete with accessories			15	Outdoor & Indoor Lighting, Electrification		
4	33/11 kV 20/26MVA ONAN/ONAF Transformer complete with accessories			16	Fire Fighting equipment		
5	AC & DC Distribution Panel with interlocking and necessary accessories & connector			17	LV MCCB Panel		
6	Battery and Battery Charger (110V) with necessary accessories & connector			18	Air Conditioner of 48,000 BTU split type		
7	33 kV XLPE (Cu) Cable as required			19	CCTV Camera with night vision		
8	11 kV XLPE (Cu) Cable as required			20	33kV VCB & PCM		
9	33KV 3Cx95 Sq.mm XLPE (Cu) Cable & & 0.415 kV PVC Cu Cable			21	SAS		
10	Station type 33 kV & 11kV Surge Arrester including surge Monitor/counter LA			22	33kV CT & PT		
11	All Cable termination (33KV,11KV & 0.415KV)			23	Energy meter		
12	Control Cable and LV Power Cables			24	RTCC Panel		

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

N.B. The Tenderer has to item wise declare country of Origin as per ITT 6.3 and country of shipment, place of manufacture with technical proposal and during bid. If any of the offered item's country of Origin differs from his declaration during supply of the item(s), the item shall not be accepted. The country of origin shall be specific country and no alternative offer is accepted.

Schedule No. 2 - Plant and Mandatory Spare Parts Supplied from within the Employer's Country

1. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1					
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
	required accessories- 5Set (1 set =03 Nos).							
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -12Nos.	Set	**1**					
4	Supply of Station Transformer 33/11 KV, 20/26MV with fuse assembly including all accessories	Set	2					
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	2					
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150	Set	2					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
	volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .	Set	1					
	b) Supply of DC Distribution Panel including all accessories.	Set	1					
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter.	Lot	1					
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 300 meter.	Lot	1					
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1					
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1					
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
	necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.							
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.							
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.	Lot	1					
16	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	14					
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1					
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.	Lot	1					
19	Outdoor and Indoor Lighting System.	Lot	1					
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm	Lot	1					

Line Item No.	Description of Item	Quantity	Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3	4	5=3x4	6	7=5+6
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary						

Note:*1. *Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

2. **Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1					
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 5 Set (1 set =03 Nos).	Lot	1					
3	Supply of 11 kV indoor Gas Insulated Switchgear	Set	**1**					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
	(GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -12 Nos.							
4	Supply of Station Transformer 33/11 KV, 20/26MV with fuse assembly including all accessories	Set	2					
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	2					
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.	Set	2					
8	a) Supply of Battery, 110 volt DC nominal, 150							

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
	Ah minimum with mounting rack including accessories.	Set	1					
	b) Supply of DC Distribution Panel including all accessories.	Set	1					
9	Supply of 33 kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter.	Lot	1					
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 300 meter.	Lot	1					
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1					
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1					
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3x4		6	7=5+6
	4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.							
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1					
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	14					
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1					
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.	Lot	1					
19	Outdoor and Indoor Lighting System.	Lot	1					
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

3. Name of the Work: **Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram.** **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1					
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-4 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-9 Set (1 set =03 Nos).	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -8 Nos.	Set	1					
4	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	1					
5	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
6	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.	Set	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
7	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .	Set	1					
	b) Supply of DC Distribution Panel including all accessories.	Set	1					
8	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter.	Lot	1					
	Supply of 1C×800sq. mm XLPE (Cu) Cable for 33kV incoming feeder as per requirement. As per field requirement but not less than 480 meter.							
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 960 meter.							
9	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 420 meter.	Lot	1					
10	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
11	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 640 meter.	Lot	1					
12	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	outdoor) including all accessories.							
13	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1					
14	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1					
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
15	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	10					
16	Substation Automation System (SAS) including all accessories.	Lot	1					
17	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.	Lot	1					
18	Outdoor and Indoor Lighting System.	Lot	1					
19	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
20	Supply of Fire Detection & Fire Fighting Equipment with Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note:*1. *Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

4. Name of the Work: **Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.** **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1					
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-7 Set (1 set =03 Nos).	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -12 Nos.	Set	1					
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer (Outdoor type) with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2					
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	1					
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and	Set	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .	Set	1					
	b) Supply of DC Distribution Panel including all accessories.	Set	1					
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter. Supply of 1C×800sq. mm XLPE (Cu) Cable for 33kV Incoming feeder as per requirement. As per field requirement but not less than 480 meter. Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.	Lot	1					
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 420 meter.	Lot	1					
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1					
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1					
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1					
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	14					
17	Substation Automation System (SAS) including all accessories.	Lot	1					
18	Supply of split type Air conditioner, 48,000 BTU/hour capacity but not limited to.	Lot	1					
19	Outdoor and Indoor Lighting System.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	**2**	**3**		**4**	**5=3X4**		**6**	**7=5+6**
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

5. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone . GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos. GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No. GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos. GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.	Set	1					
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-7 Set (1 set =03 Nos).	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels.All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -12Nos.	Set	1					
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer (Outdoor type) with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2					
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	1					
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
7	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and	Set	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories .	Set	1					
	b) Supply of DC Distribution Panel including all accessories.							
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter.	Lot	1					
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 420 meter.	Lot	1					
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1					
13	Supply of all Cable termination kits in line with	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.							
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1					
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1					
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	14					
17	Substation Automation System (SAS) including all accessories.	Lot	1					
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.	Lot	1					
19	Outdoor and Indoor Lighting System.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

6. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.

(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfaceing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1					
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-5 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -2 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-3 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1 No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories-11 Set (1 set =03 Nos).	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-3 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-2 No. GIS cubicles Outgoing Feeders (630 A) -18 Nos.	Set	1					
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer (Outdoor type) with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2					
5	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	1					
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
7	Supply of Battery Charger, constant voltage type	Set	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	(adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.							
8	a) Supply of Battery, 110 volt DC nominal, 150 Ah minimum with mounting rack including accessories.	Set	1					
	b) Supply of DC Distribution Panel including all accessories.							
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 225 meter.	Lot	1					
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 960 meter.							
10	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 450 meter.	Lot	1					
11	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 1440 meter.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1					
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1					
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1					
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
16	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	21					
17	Substation Automation System (SAS) including all accessories.	Lot	1					
18	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to. (4 nos)	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
19	Outdoor and Indoor Lighting System.	Lot	1					
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					
21	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note:1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

7. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
1	33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 3150 Ampere Double Bus,, GIS cubicles for 1 Bus Sectionaliser (3150A), 2 sets of 33 kV Bus PTs and 33 kV Isolators, Lightning Arrestors and other related accessories as needed along with 33 kV Control, Protection and Metering system housed in the same 33 kV GIS panels and 17 Circuit Breakers (1250A) . All the Circuit Breaker's control with Local/ Remote switch metering and status data shall be brought under Substation Automation System and interfaced with the existing BPDB's SCADA system in Chattogram but not limited to.	Set	1					
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.							
	GIS cubicles Outgoing Feeders (1250A) with PT-17 Nos.							
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (3150 A) -1 No.							
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.							
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.							
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	required accessories- 20 Set (1 set =03 Nos).							
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone. GIS cubicles Incoming Feeders (2500A) with PT-2 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (315 A)-1 No. GIS cubicles Outgoing Feeders (630 A) -10 Nos.	Set	1					
4	Supply of Station Transformer 33/0.4 KV, 250 kVA with fuse assembly including all accessories	Set	1					
5	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including KWh meter (accuracy class 1.0) for station supply including all accessories	Set	1					
6	Supply of Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 400 volts, output DC 110 - 150 volts including all accessories.	Set	2					
7	a) Supply of Battery, 110 volt DC nominal, 150	Set	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
	Ah minimum with mounting rack including accessories.							
	b) Supply of DC Distribution Panel including all accessories.							
8	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter.	Lot	1					
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 4080 meter.							
	Supply of 1C×800sq. mm XLPE (Cu) Cable for 33kV Incoming feeder as per requirement. As per field requirement but not less than 1440 meter							
9	Supply of 11 kV Single core XLPE copper cable 2x1Cx630 Sq. mm per phase as required. As per field requirement but not less than 300 meter.	Lot	1					
10	Supply of 33 kV 3C×95 sq. mm XLPE (Cu) Cable and 0.415 kV, 4Cx 185 sq.mm PVC (Cu) Cable for Station Transformer as required	Lot	1					
11	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 800 meter.	Lot	1					
12	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
13	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1					
14	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1					
	a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.							
15	Supply of Station type 11 kV Surge Arrester including all accessories.	Set (1 set =03 Nos)	12					
16	Substation Automation System (SAS) including all accessories.	Lot	1					
17	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.(4 Nos)	Lot	1					
18	Outdoor and Indoor Lighting System.	Lot	1					
19	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	**2**	**3**		**4**	**5=3X4**		**6**	**7=5+6**
20	Supply of **Fire Detection & Fire Fighting Equipment with** Smoke Detection & alarm System a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note:*1. *Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6, 7& 8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

08. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
1	33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 3150 Ampere Double Bus,, GIS cubicles for 1 Bus Sectionaliser (3150A), 2 sets of 33 kV Bus PTs and 33 kV Isolators, Lightning Arrestors and other related accessories as needed along with 33 kV Control, Protection and Metering system housed in the same 33 kV GIS panels and 17 Circuit Breakers (1250A) . All the Circuit Breaker's control with Local/ Remote switch metering and status data shall be brought under Substation Automation System and interfaced with the existing BPDB's SCADA system in Chattogram but not limited to. GIS cubicles Incoming Feeders (2000A) with PT- 2 Nos. GIS cubicles Outgoing Feeders (1600A) with PT-04 Nos. GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.	Set	1					
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 20 Set (1 set =03 Nos).	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5=3X4		6	7=5+6
3	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 960 meter. Supply of 1C×800sq. mm XLPE (Cu) Cable for 33kV Incoming feeder as per requirement. As per field requirement but not less than 720 meter	Lot	1					
04	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1					
05	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1					
06	Supply of all material for Grounding System, Earthing mesh with earthling electrode. a) Supply of grounding copper conductor (As per scope of works and technical Specification). b)Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement. (b)	Lot	1					

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)		Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	**2**	**3**		**4**	**5=3X4**		**6**	**7=5+6**
07	Supply of split type Air conditioner,48,000 BTU/hour capacity but not limited to.(4 Nos)	Lot	1					
08	Outdoor and Indoor Lighting System.	Lot	1					
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary								

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

09. Name of the Work: Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram. **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.2)**

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5 = 3 x 4	6	7 = 5 + 6
1	33 kV Vacuum Circuit Breaker, 1600 A, 25 kA for 3 sec. outdoor type along with supporting structure and accessories.	Set	2				
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories. (2 Sets, 1 Set=3 Nos)	Lot	1				
3	33 kV Isolator 1600A, 25 kA for 3 sec. without earthling blade gang operated vertical mounted vertical break with galvanized steel support structure and necessary connectors and accessories. (2 Sets, 1 Set=3 Nos)	Set	2				
4	33 kV line isolator 1600A, 25 kA for 3 sec. with earthling blade gang operated vertical mounted vertical break with galvanized steel support structure and necessary connectors and all accessories. (2 Sets, 1 Set=3 Nos)	Set	2				
5	33 kV 3 × single phase Current Transformer (3 nos. per circuit) outdoor type ratio 1200-2400/5/5A class 5P10 for protection and 0.2 for measuring along with supporting steel structure and suitable bi-metallic connectors and accessories as per field requirement.	Set	1				
6	Suitable busbar Droppers, Conductors, Connectors, outdoor marshal kiosk, hardware clamps, nuts and bolts, etc. as required for connecting the individual items of equipment of 33 kV switchyard & complete bay extension.	Lot	1				
7	PG Clamps including all other Clamps as Required	Lot	1				

Line Item No.	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5 = 3 x 4	6	7 = 5 + 6
8	33 kV Disc Insulator set with necessary suitable front and back connecting clamps.	Lot	1				
9	33 kV control, metering and protection panel for 33 kV line feeder with 2 O/C, 1 E/F (IDMT and Ins). 2 Directional O/C + 1 Directional E/F relays including audio visual annunciator and all accessories						
10	All Control Cables including CT and PT cables and LV Power Cables with all accessories between Control Room panels and 33kV switchyard equipment.	Lot	1				
11	All material for grounding connection of individual equipment with substation mesh, 185 mm^2 grounding copper conductor, suitable connector and earthling electrode as required to achieve Earth Resistance as per standard and all accessories.	Lot	1				
12	33 kV control, metering and protection panel for 33 kV line feeder with 2 O/C, 1 E/F (IDMT and Ins). 2 Directional O/C + 1 Directional E/F relays including audio visual annunciator and all accessories.						
TOTAL Column 7 to be carried forward to Schedule No. 6. Grand Summary							

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

10. Name of the Work: Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to chawk bazar 33/11 kV Substation BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)

Line Item No	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5 = 3 x 4	6	7 = 5 + 6
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....	KM	31.35				
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories	Sets	60				
3	33KV Cable Outdoor termination Complete kit.....	Sets	0				
4	Ø150 mm MPP Pipe	Meter	3120				
5	Plastic Cable ties	Sets	2327				
6	24 Core optical fiber including Silicon tube, Galvanised steel pipe.	KM	10.45				
7	Optical fiber cable termination equipment exclusive of all accessories.	Sets	2				
8	Ø40 mm HDPE Pipe	Meter	10450				
9	Ø63 mm PVC Pipe.	Meter	1320				
10	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.	Sets	2				

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*

Duly authorised to sign the Tender for and on behalf of the Tenderer

11. **Name of the Work:** Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram **(Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)**

Line Item No	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5 = 3 x 4	6	7 = 5 + 6
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....	KM	29.70				
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories	Sets	60				
3	Ø150 mm MPP Pipe for Road crossing, Culvert/Bridge and Railway level crossing	Meter	2760				
4	Best quality of Plastic Cable ties	Sets	2227				
5	24 Core optical fiber including Silicon tube, Galvanised steel pipe.	KM	9.90				
6	Optical fiber cable joint box all accessories.	Lot	0				
7	Optical fiber cable termination equipment exclusive of all accessories.	Sets	2				
8	Ø40 mm HDPE Pipe	Meter	9900				
9	Ø63 mm PVC Pipe.	Meter	1200				
10	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.	Sets	2				

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*

Duly authorised to sign the Tender for and on behalf of the Tenderer

12. Name of the Work: **Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Khulsi Stadium rising Pole Grid to Stadium 33/11 kV Substation BPDB, Chattogram.** (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)

Line Item No	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5 = 3 x 4	6	7 = 5 + 6
1	33 KV 1x 800mm² XLPE Armoured Copper Cable.....	1.65	1.65				
2	33KV Cable Outdoor termination Complete kits.....	6	6				
3	33KV Cable Indoor GIS termination Complete kits.....	6	6				
4	Clamp, Cable holder in S/S Side..as required	6	6				
5	200 mm HDPE Pipe	60	1				
6	15M SPC D Type Pole	Nos	2				
7	33kv Tension type Cross arm	Sets	2				
8	Double Stud clamp with Nuts and Bolts as required	Nos	8				
9	3 Meter M.S. Channel with Nuts and Bolts as required	Sets	2				
10	33KV Disc Insulator With Tension Clamp	Sets	6				
11	Cable cleat clamp with Nuts & Bolt	Sets	700				

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

13. Name of the Work: Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram. (Bidder shall quote price considering the requirement to complete Substation as per BOQ Clause 6.4)

Line Item No	Description of Item	Quantity		Unit Price EXW (Foreign Currency or Taka)	Total EXW Price (Foreign Currency or Taka)	Sales Tax (Foreign Currency or Taka)	Total Price (Foreign Currency or Taka)
1	2	3		4	5 = 3 x 4	6	7 = 5 + 6
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....	KM	23.10				
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories	Sets	48				
3	Ø150 mm MPP Pipe	Meter	1200				
4	Plastic Cable ties	Sets	1694				
5	24 Core optical fiber including Silicon tube, Galvanised steel pipe.	KM	7.70				
6	Optical fiber cable joint box all accessories.	Lot	0				
7	Optical fiber cable termination equipment exclusive of all accessories.	Sets	2				
8	Ø40 mm HDPE Pipe	Meter	7700				
9	Ø63 mm PVC Pipe.	Meter	240				
10	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.	Sets	2				

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***
[1]*Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

14. Name of the Work: Mandatory Spare parts

Line Item No	Description of Item	Country of Origin *[Ref. as per ITT 6.3]*	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
1	Supply of HT Bushing for 20/26MVA Power Transformer (1 Set = 3 Nos.)		Sets	2				
2	Supply of LT Bushing for 20/26MVA Power Transformer (1 Set = 4 Nos.)		Sets	2				
3	Supply of 33kV, Single phase Post type Lightning Arrester (ZnO-type), Class-3		Sets (3 nos.= 1 set)	5				
4	Supply of 11kV, Single phase Post type Lightning Arrester (ZnO-type), Class-2		Sets (3 nos.= 1 set)	10				
5	Supply of Closing Coil for GIS panel		Sets	10				
6	Supply of Tripping Coil for GIS panel		Sets	10				
7	Supply of Universal Motor/Spring Charge motor for 11kV GIS panel		Sets	5				
8	Supply of Universal Motor/Spring Charge motor for 33kV GIS panel		Sets	5				
9	Supply of Differential Relay, 3 O/C + 1 E/F + 3 Directional O/C + 1 Directional E/F for 33kV Control Metering and Relay Panel as per technical specification.		Sets	2				
10	Supply of Bay Control and Protection Unit (BCPU), 3 Over Current + 2 Earth fault (1 E/F + 1 Separate Standby Earth Fault) + Directional O/C & E/F relay for 33kV Control Metering and Relay Panel as per technical specification.		Sets	2				

Line Item No	Description of Item	Country of Origin *[Ref. as per ITT 6.3]*	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
11	Supply of Bay Control and Protection Unit (BCPU), 3 Over Current + 2 Earth fault (1 E/F + 1 Separate Standby Earth Fault) + Directional O/C & E/F relay for 11kV Control Metering and Relay Panel as per technical specification.		Sets	5				
12	Supply of Heat shrinkable Straight through Jointing kits for 33kV, 800mm^2 Cable including all accessories		Sets	30				
13	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 33kV, 800mm^2 Cable		Sets	12				
14	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 33kV, 500mm^2 Cable		Sets	6				
15	Supply of Heat shrinkable Outdoor termination kit including all accessories for 33kV, 500mm^2 Cable		Sets	6				
16	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 11kV, 630mm^2 Cable		Sets	6				
17	Supply of Heat shrinkable Outdoor termination kit including all accessories for 11kV, 630mm^2 Cable		Sets	6				
18	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 11kV, 3x185mm^2 Cable		Sets	30				
19	Supply of Heat shrinkable Outdoor termination kit including all accessories for 11kV, 3x185mm^2 Cable		Sets	30				

Line Item No	Description of Item	Country of Origin *[Ref. as per ITT 6.3]*	Quantity		Unit Price CIP [Project Site, as per GCC 1.1 (oo)] [FC]		CIP price per Line Item [FC]	Taxes and Duties In Local Currency
1	2	3	4		5		6 = 4 x 5	7
20	Supply of Tool box for HV Cable Jointing and Termination		Set	2				
21	Supply of Test plug for Power Cable		Sets	2				
22	Supply of SFRA Testing Kit with all accessories and Software		Sets	2				
23	Supply of Cable fault locator with all accessories (EU/UK/USA/Korea/Japan/Australia make)		Sets	2				
24	Supply of Partial Discharge Measurement and Analysis of Transformer & Cable		Sets	2				
25	DS/ES Motor Control Unit/ Device/ Card for 33kV		sets	5				
26	DS/ES Motor Control Unit/ Device/ Card for 11kV		sets	5				
	Column 6 to be carried forward to Schedule No. 6. Grand Summary							

*Note:*1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies.***
Note: 2. Taxes and Duties in accordance with GCC 60.2 & PCC 60.4
Note: 3. All the equipment to be quoted as per requirement Sec.6,7&8.

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

Schedule No. 3 - Design Services

Item	Description of Item	Quantity	Unit Price		Total Price	
			Local Currency Portion	Foreign Currency Portion	Local Currency Portion	Foreign Currency Portion
(1)	(2)	(3)	(4)	(5)	(6) = (3 x 4)	(7) = (3 x 5)
Engineering and Design of the following new substation construction and bay extension as complete. (As per scope of works, Technical specification and GTP):						
01	**33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.**	LS.				
02	**33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram.**	LS.				
03	**33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram.**	LS.				
04	**33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.**	LS.				
05	**33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.**	LS.				
06	**33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.**	LS.				
07	**Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram.**	LS.				
08	**33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram.**	LS.				
09	**33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram.scent Industries 33/11 kV Substation BPDB, Chattogram.**	LS.				
10	**33 kV Underground Cable from Bakulia Grid to chawk bazar 33/11 kV Substation BPDB, Chattogram.**	LS.				
11	**33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram.**	LS.				
12	**33 kV Underground Cable from Khulsi Stadium rising Pole Grid to Stadium 33/11 kV Substation BPDB, Chattogram.**	LS.				
13	**33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram.**	LS.				

TOTAL Columns 6 and 7 to be carried forward to Schedule No. 6. Grand Summary		

[1]*Note: 1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies*
[1]*Note: 2. Taxes and Duties to be include in Total Price.*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Schedule No. 4 – Civil works part

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
1	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Three Storied GIS Sub-Station Building : Including Transformer (indoor) floor, Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	750		
	c) Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1		
	d)Road (approach including internal road & walkway etc).	Lot	1		
	e) Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	f) Tree plantation, gardening and beautification etc.	Lot	1		
	g) Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		
	Sub-Total of Item no. (1)				
2	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Three Storied GIS Sub-Station Building : Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water	Sqm	750		

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
	Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).				
	c)Four Storied Office Building : Including required rooms for staffs , O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting and other related items etc. (If required Dismantling, Demolishing).	Sqm	1600		
	d) Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1		
	e)Road (approach including internal road & walkway etc).	Lot	1		
	f) Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	g) Tree plantation, gardening and beautification etc.	Lot	1		
	h) Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		
	Sub-Total of Item no. (2)				
3	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Two Storied GIS Sub-Station Building : Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	500		
	c) Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable	Lot	1		

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
	Tray/Rack & others.				
	d)Road (approach including internal road & walkway etc).	Lot	1		
	e) Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	f) Tree plantation, gardening and beautification etc.	Lot	1		
	g) Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		
	Sub-Total of Item no. (3)				
4	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Two Storied GIS Sub-Station Building : Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	500		
	c) Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1		
	d) Road (approach including internal road & walkway etc).	Lot	1		
	e) Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	f) Tree plantation, gardening and beautification etc.	Lot	1		
	g) Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
	Sub-Total of Item no. (4)				
5	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Two Storied GIS Sub-Station Building : Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	500		
	c) Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1		
	d)Road (approach including internal road & walkway etc).	Lot	1		
	e) Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	f) Tree plantation, gardening and beautification etc.	Lot	1		
	g) Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		
	Sub-Total of Item no. (5)				
6	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Three Storied GIS Sub-Station Building : Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification,	Sqm	840		

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
	Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).				
	c) Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1		
	d)Road (approach including internal road & walkway etc).	Lot	1		
	e) Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	f) Tree plantation, gardening and beautification etc.	Lot	1		
	g) Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		
	Sub-Total of Item no. (6)				
7	**Design, Supply, Erection, Installation, Testing and Commissioning of Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram.**				
	a) Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1		
	b)Three Storied GIS Sub-Station Building : Including Transformer (indoor) floor, Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	750		
	c)Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1		
	d)Road (approach including internal road & walkway etc).	Lot	1		
	e)Boundary Wall (with retaining where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1		
	f)Tree plantation, gardening and beautification etc.	Lot	1		
	g)Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1		

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
	Sub-Total of Item no. (7)				
8	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram.**				
	1) All other items (GIS & Control Room Extension etc (35x2 sq m)) which will be necessary to complete the total substation works.	Lot	1		
	Sub-Total of Item no. (8)				
9	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram.**				
	a) Earth filling and compaction as needed, Gravel Pit, Laying of Gravel etc.	Lot	1		
	b) Substation switchyard extension, gantry as needed etc.	Lot	1		
	c) Foundation of Equipment, Power & Control Cable Trench etc.	Lot	1		
	Sub-Total of Item no. (9)				
10	**Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to chawk bazar 33/11 kV Substation BPDB, Chattogram.**				
	a) H.D Drilling for Road crossing, Culvert/Bridge and Railway level cross.	Meter	3120		
	b)Excavation of Soil as required.	Cum	6282		
	c)Breaking of pucca surface as required.	Sq. Meter	4188		
	d)Backfilling by fine graded sand as required.	Cum	4188		
	e)Backfilling by Picket/Brick chips with sand (1:1)	Cum	1677		
	f) R. C.C. slab (1:1.5:3) & Cable joint inspection Pit	Cum	441		
	Sub-Total of Item no. (10)				

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
11	**Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram.**				
	a)H.D Drilling for Road crossing, Culvert/Bridge and Railway level cross.	Meter	2760		
	b)Excavation of Soil as required.	Cum	6012		
	c)Breaking of pucca surface as required.	Sq. Meter	4008		
	d)Backfilling by fine graded sand as required.	Cum	5210		
	e)Backfilling by Picket/Brick chips with sand (1:1)	Cum	2084		
	f)R. C.C. slab (1:1.5:3) & Cable joint inspection Pit	Cum	368		
	Sub-Total of Item no. (11)				
12	**Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Khulsi Stadium rising Pole Grid to Stadium 33/11 kV Substation BPDB, Chattogram.**				
	a)RCC cable Duct (1:1.5:3)	Cum	138		
	b)Excavation Soil....	Cum	320		
	Sub-Total of Item no. (12)				
13	**Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram.**				
	a)H.D Drilling for Road crossing, Culvert/Bridge and Railway level cross.	Meter	1200		
	b)Excavation of Soil as required.	Cum	4572		
	c)Breaking of pucca surface as required.	Sq. Meter	3048		

Item	Description of items	Unit	Quantity	Rate	Amount
1	2	3	4	5	6 = 4*5
	d)Backfilling by fine graded sand as required.	Cum	3962		
	e)Backfilling by Picket/Brick chips with sand (1:1)	Cum	1585		
	f)R. C.C. slab (1:1.5:3) & Cable joint inspection Pit	Cum	324		
	Sub-Total of Item no. (13)				

Schedule No. 5- Installation and Other Services

Item	Description	Quantity	Unit Price		Total Price	
			Local Currency Portion	Foreign Currency Portion	Local Currency Portion	Foreign Currency Portion
1	2	3	4	5	6 = 3 x 4	7 = 3 x 5
Construction & Installation of the following sub-stations including local transportation, erection, testing, commissioning, dismantling work as per field requirement, inspection, training and Energizing of Complete Sub-station. (As per Scope of Works, Technical Specification and GTP):						
1	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
2	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
3	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB,**					

	Chattogram.					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
4	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
5	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
6	**Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
7	**Design, Supply, Erection, Installation, Testing and Commissioning of Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				

8	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	LS				
	(b), Training (class room & on the job) at site	LS				
9	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram.**					
	(a)Installation, Testing, Commissioning of all Equipment.	LS				
	(b) Training (class room & on the job) at site	LS				
10	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to chawk bazar 33/11 kV Substation BPDB, Chattogram**					
	(a)Installation, Testing, Commissioning of all Equipment.	LS				
	(b) Training (class room & on the job) at site	LS				
11	**Design, Supply, Erection, Installation, Testing and Commissioning of** 33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram.					
	(a)Installation, Testing, Commissioning of all Equipment.	LS				
	(b) Training (class room & on the job) at site	LS				
12	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Khulsi Stadium rising Pole Grid to Stadium 33/11 kV Substation BPDB, Chattogram.**					

	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				
13	**Design, Supply, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram**					
	(a)Installation, Testing, Commissioning of all Equipment.	**LS**				
	(b) Training (class room & on the job) at site	**LS**				

TOTAL Columns 6 and 7 to be carried forward to Schedule No. 6. Grand Summary

Note: 1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies
[1]*Note: 2. Taxes and Duties to be include in Total Price.*

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Schedule No. 6 - Grand Summary

Schedule No.	Title	Total Price (Tender Price)	
		Foreign Currency	Local Currency
1	Plant and Mandatory Spare Parts Supplied from Abroad		
2	Plant and Mandatory Spare Parts Supplied from Within the Employer's Country		
3	Design Services		
4	Civil works part		
5	Installation and Other Services		
GRAND TOTAL to be carried forward to Form PG5A-1b			

Note: 1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies
2. Create additional columns for up to a maximum of 3 Foreign Currencies if so required
3. Contract Price shall be the Tender Price considering arithmetic correction and unconditional discount (if any).

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Schedule No. 7 - Recommended Spare Parts (Not in Evaluation)

Item	Description	Qty	Unit Price		Total Price	
			EXW Local Parts Local Currency	CIP Imported Parts Foreign Currency	Local Currency Portion	Foreign Currency Portion
1	2	3	4	5	6 = 3 x 4	7 = 3 x 5
	TOTAL					

Note: 1. ***Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies***

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorized to sign the Tender for and on behalf of the Tenderer		

Technical Proposal (Form PG5A-4)

[The Revised Technical Proposal, if any, shall follow the same format and structure]

Site Organization

Method Statement

Mobilization Structure

Construction Structure

Plant

Safety Plan

Personnel

Equipment

Proposed subcontractors for Major Items of Plant and Services

Time Schedule

Site Organization

[insert technical proposal for site organization]

[The Tenderer shall include in the tender an appropriate organization chart. This shall include head office as well as site components and clearly demonstrate that the Tenderer possesses the staff and organizational resources to complete the Supply and Installation of Plant & Equipment.]

Method Statement

[insert technical proposal for Method Statement]

[The Tenderer shall furnish an overall description covering all activities and processes from inception to site works and commissioning.
In particular methods of minimizing the impact on the environment in accordance with the relevant laws and regulations during the construction phase shall be described.]

Mobilization Schedule

[insert technical proposal for Mobilization Schedule]

[This shall be included in the overall time schedule to be provided by the Tenderer as per "Time Schedule" in Section 5.Tendering Forms

Construction Schedule

[insert technical proposal for Construction Schedule]

[This shall be included in the overall time schedule to be provided by the Tenderer as per "Time Schedule" in Section5. Tendering Forms]

Plant

*[insert technical proposal for **Plant**]*

[The Tenderer shall provide the plant and equipment it intends to use in the construction process to demonstrate that it has the capability to complete the Supply and Installation of Plant & Equipment.]

Safety Plan

*[Insert technical proposal for **Safety Plan**]*

[The Tenderer shall demonstrate that it has a comprehensive safety system that will be used during the construction and installation phase. This system shall meet all safety requirements in accordance with all relevant laws, rules and regulations.]

Personnel Information

[This Form should be completed for each person proposed by the Tenderer on Form PG5A-2a& PG5A-2b, where applicable]

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

A.	**Proposed Position** (tick the relevant box)		
B.	**Personal Data**		
Name			
Date of Birth			
Years overall experience			
Years of specific experience			
National ID Number			
Years of employment with the Tenderer			
B. Professional Qualifications: 1. 2.			
C.	**Present Employment** *[to be completed only if not employed by the Tenderer]*		
Name of Procuring Entity:			
Address of Procuring Entity:			
Present Job Title:			
Years with present Procuring Entity:			
Tel No:	Fax No:	e-mail address:	
Contact *[manager/personnel officer]:*			

D.	**Professional Experience**		
Summarise professional experience over the last twenty years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.			
	From	To	Company / Project / Position / Relevant technical and management experience.
1			
2			
3			

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Equipment Information

[The Tenderer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in TDS . A Separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Tenderer]

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of Lot(s)]*

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Tenderer.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

Name:	*[insert full name of signatory]*	*Signature with Date and Seal*
In the capacity of:	*[insert designation of signatory]*	*[Sign]*
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Proposed Subcontractors for Major Items of Plant and Installation Services

A list of major items of Plant and Installation Services is provided below.

The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated. Tenderers are free to propose more than one for each item

Major Items of Plant and Installation Services	**Proposed Subcontractors/Manufacturers**	**Nationality**

Form Functional Guarantee

The Tenderer shall copy in the left column of the table below, the identification of each functional guarantee required in the Specification and stated by the Employer in GCC 43 and in the right column, provide the corresponding value for each functional guarantee of the proposed plant and equipment.

Invitation for Tender No:	*[indicate IFT No]*
Tender Package No	*[indicate Package No]*
This Package is divided into the following Number of Lots	*[indicate number of ot(s)]*

Required Functional Guarantee	**Value of Functional Guarantee of the Proposed Plant and Equipment**
1.	
2.	
3.	
4.	
5.	
6.	

Specifications Submission and Compliance Sheet (Form PG5A-4a)

Invitation for Tender No: Date:
Tender Package No: Package Description: *[enter description as specified in Section 6]*

Tender Lot No: Lot Description: *[enter description as specified in Section 6]*

Item No.	Name of Goods or Related Service	Country of Origin	Make and Model (*when applicable)*	Full Technical Specifications and Standards
1	**2**	3	4	5
	FOR GOODS			Note 1
	FOR RELATED SERVICES			

[The Tenderer should complete all the columns as required]

Signature:	*[insert signature of authorised representative of the Tenderer]*
Name:	*[insert full name of signatory with National ID]*
In the capacity of:	*[insert designation of signatory]*
Duly authorised to sign the Tender for and on behalf of the Tenderer	

Manufacturer's Authorisation Letter (Form PG5A - 5)

[The Tenderer shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. Thisletter 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 Tenderer shall include it in its tender, if so indicated in the ***TDS as stated under ITT Sub-Clause 29.3(b)****]*

Invitation for Tender No:	Date:
Tender Package No:	
Tender Lot No:	
To: Name and address of Employer]	

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 Tenderer]* to supply the following Plant and Equipment, manufactured by us *[insert name and or brief description of the Goods]*.

We hereby extend our full guarantee and warranty as stated under GCC Clause 42 of the General Conditions of Contract, with respect to the Goods offered by the above Tenderer.

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

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*
Address: *[insert full address including Fax and e-mail]*
Title: *[insert title]*

Date: *[insert date of signing]*

Bank Guarantee for Tender Security (Form PG5A– 6)

[this is the format for the Tender Security to be issued by a scheduled bank of Bangladesh as stated under ITT Clauses32 and 33]

Invitation for Tender No: Date:

Tender Package No:

Tender Lot No:
To:
[Name and address of Employer]

TENDER GUARANTEE No:

We have been informed that *[insert name of Tenderer]* (hereinafter called "the Tenderer") intends to submit to you its Tender dated *[insert date of Tender]* (hereinafter called "the Tender") for the supply and installation of *[description of plant and services]* under the above Invitation for Tenders (hereinafter called "the IFT").

Furthermore, we understand that, according to your conditions, Tenders must be supported by a Bank Guarantee for Tender Security .

At the request of the Tenderer, we *[insert name of bank]* hereby irrevocably and unconditionally undertake to pay you, without cavil or argument, any sum or sums not exceeding in total an amount of Tk.*[insert amount in figures and in words]* upon receipt by us of your first written demand accompanied by a written statement that the Tenderer is in breach of its obligation(s) under the Tender conditions, because the Tenderer:

a. has withdrawn its Tender after opening of Tenders but within the validity of the Tender Security ; or
b. refused to accept the Notification of Award (NOA) within the period as stated under Instructions to Tenderers (ITT) ; or
c. failed to furnish Performance Security within the period as stipulated in the NOA; or
d. refused to sign the Contract Agreement by the time specified in the NOA; or
e. did not accept the correction of the Tender price following the correction of the arithmetic errors in accordance with the ITT; or

This guarantee will expire:

(a) if the Tenderer is the successful Tenderer, upon our receipt of a copies of the contract signed by the Tenderer and the Performance Security issued to you in accordance with the ITT; or

(b) if the Tenderer is not the successful Tenderer,twenty eight (28) days after the expiration of the Tenderer's Tender validity period, being [*date of expiration of the Tender validity plus twenty eight(28) days]*

Consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

Letter of Commitment for Bank's undertaking for Line of Credit (Form PG5A-6a)

[This is the format for the Credit Line to be issued by any scheduled Bank of Bangladesh in accordance with ITT Clause 15.1(b)]

Invitation for Tender No: Date:

Tender Package No:

Lot No (*when applicable*)
To:

[*Name and address of the Procuring Entity*]

CREDIT COMMITTMENT No: [insert number]

We have been informed that *[name of Tenderer]* (hereinafter called "the Tenderer") intends to submit to you its Tender (hereinafter called "the Tender") for the execution of the Supply and Installation of Plant & Equipment of *[description of works]* under the above Invitation for Tenders (hereinafter called "the IFT").

Furthermore, we understand that, according to your conditions, the Tenderer's Financial Capacity i.e. Liquid Asset must be substantiated by a Letter of Commitment of Bank's Undertaking for Line of Credit.

At the request of, and arrangement with, the Tenderer, we *[name and address of the Bank]* do hereby agree and undertake that [*name and address of the Tenderer*] will be provided by us with a revolving line of credit, in case awarded the Contract, for execution of the Works viz. [*insert name of works*], for an amount not less than BDT [*in figure*](*in words*) for the sole purpose of the execution of the above Contract. This Revolving Line of Credit will be maintained by us until issuance of "**Taking-Over Certificate**" by the Procuring Entity.

In witness whereof, authorised representative of the Bank has hereunto signed and sealed this Letter of Commitment.

Signature Signature

Deviation List (Form PG5A – 13)

[*If Tenderer has any reservation on terms and conditions, Tenderer has to mention his reservations in Deviation list*]

Sl. No.	Reference No./ Clause No.	Proposed Deviation	Remarks

[*Add rows if necessary*]

Signature: *[insert signature of authorised representative of the Tenderer]*

Name: *[insert full name of signatory]*

In the capacity of: *[insert designation of signatory]*

Duly authorised to sign the Tender for and on behalf of the Tenderer

Notification of Award (Form PG5A - 7)

Contract No: Date:
To:

[Name of Contractor]

This is to notify you that your Tender dated *[insert date]* for the supply and installation of plant and Services for *[name of contract]* for the Contract Price of *[state amount in figures and in words]* as corrected and modified in accordance with the Instructions to Tenderers, has been approved by *[name of Employer].*

You are thus requested to take following actions:

i. accept in writing the Notification of Award within seven (7) working days of its issuance pursuant to ITT Sub-Clause 64.1

ii. furnish a Performance Security in the specified format and in the amount of Tk.*[state amount in figures and words]* ,within Twenty-eight (28) days from issue of this Notification of Award but not later than *(specify date),* in accordance with ITT Clause 64.3

iii. sign the Contract within twenty eight (28) days of issuance of this Notification of Award but not later than *(specify date),* in accordance with ITT Clause 69.2

You may proceed with the execution of the supply of Plant and Services only upon completion of the above tasks. You may also please note that this Notification of Award shall constitute the formation of this Contract, which shall become binding upon you.

We attach the draft Contract and all other documents for your perusal and signature.

Signed

Duly authorised to sign for and on behalf of *[name of Employer]*

Date:

Contract Agreement (Form PG5A - 8)

THIS AGREEMENT made the *[day]* day of *[month][year]* between *[name and address of Employer]* (hereinafter called "the Employer") of the one part and *[name and address of* Contractor*]* (hereinafter called "the Contractor") of the other part:

WHEREAS the Employer invited Tenders for certain plant and services, viz, *[brief description of plant and services]* and has accepted a Tender by the Contractor for the supply of those plant and services in the sum of Taka *[Contract Price in figures and in words]* (hereinafter called "the Contract Price").

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the General Conditions of Contract hereafter referred to.
2. The following documents forming the Contract shall be in the following order of precedence, namely :
    - (a) the signed Form of Contract Agreement;
    - (b) the Notification of Award
    - (c) The Tender and the appendices to the Tender
    - (d) Particular Conditions of Contract;
    - (e) General Conditions of Contract;
    - (f) Technical Specifications;
    - (g) Drawings;
    - (h) Price Schedules of Plant and Equipment and;
    - (i) other document including correspondences listed in the PCC forming part of the Contract
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to provide the plants and related services and to remedy any defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the provision of the plant 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.
5. The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement. Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS whereof the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives in accordance with the laws of Bangladesh on the day, month and year first written above.

Signed by, for and on behalf of the Employer

For the Employer:	**For the Contractor:**
Signature	
Print Name	
Title	
In the presence of Name	
Address	

Bank Guarantee for Performance Security (Form PG5A – 9)

*[This is the format for the Performance Security to be issued by **an internationally reputable bank and it shall have correspondent bank located in Bangladesh, to make it enforceable**in accordance with ITT Sub-Clause 67.1pursuant to Rule 27(4) of the Public Procurement Rules, 2008.]*

Contract No: Date:

To:

[Name and address of Employer]

PERFORMANCE GUARANTEE No: *[insert Performance Guarantee number]*

We have been informed that *[name of* Contractor*]* (hereinafter called "the Contractor") has undertaken, pursuant to Contract No *[reference number of Contract]* dated *[date of Contract]* (hereinafter called "the Contract") for the supply and installation of *[description of plant and services]* under the Contract.

Furthermore, we understand that, according to your conditions, Contracts must be supported by a performance guarantee.

At the request of the Contractor, we *[name of bank]* hereby irrevocably and unconditionally undertake to pay you, without cavil or argument, any sum or sums not exceeding in total an amount of Tk.*[insert amount in figures and in words]* upon receipt by us of your first written demand accompanied by a written statement that the Supplier is in breach of its obligation(s) under the Contract conditions, without you needing to prove or show grounds or reasons for your demand of the sum specified therein.

This guarantee is valid until *[date of validity of guarantee]*, consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

[Signatures of authorized representatives of the bank]

Signature Seal

Bank Guarantee for Advance Payment (Form PG5A – 10)

*[this is the format for the Advance Payment Security to be issued by **an internationally reputable bank and it shall have correspondent bank located in Bangladesh, to make it enforceable** in accordance with GCC Clause 57.1]*

Contract No: Date:

To:

[Name and address of Employer]

ADVANCE PAYMENT GUARANTEE No.:

We have been informed that *[name of* Contractor*]* (hereinafter called "the Contractor") has undertaken, pursuant to Contract No *[reference number of Contract]* dated *[date of Contract]* (hereinafter called "the Contract") for the supply and installation of *[description of plant and services]* under the Contract.

Furthermore, we understand that, according to your Particular Conditions of Contract Clause 26.1, Advance Payment(s) on Contracts must be supported by a bank guarantee.

At the request of the Contractor, we *[name of bank]* hereby irrevocably unconditionally undertake to pay you, without cavil or argument, any sum or sums not exceeding in total an amount of Tk.*[insert amount in figures and in words]* upon receipt by us of your first written demand accompanied by a written statement that the Contractor is in breach of its obligation(s) under the Contract conditions, without you needing to prove or show grounds or reasons for your demand of the sum specified therein.

We further agree that no change, addition or other modification of the terms of the Contract to be performed, or of any of the Contract documents which may be made between the Employer and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee is valid until *[date of validity of guarantee]*, consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

[Signatures of authorized representatives of the bank]

Signature Seal

Bank Guarantee for Retention Money Security (Form PG5A-11)

[This is the format for the Retention Money Guarantee to be issued by any scheduled Bank of Bangladesh in accordance with GCC Clause 57]

Demand Guarantee

[Bank's Name, and Address of Issuing Branch or Office]

Beneficiary: [insert Name and Address of the Procuring Entity]

Date: [insert date]

RETENTION MONEY GUARANTEE No.: [insert number]

We have been informed that [insert name of Contractor] (hereinafter called "the Contractor") has entered into Contract Number [insert reference number of the Contract] dated [insert date] with you, for the execution of [insert name of Contract and brief description of Works] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment, payment of Tk. [insert the amount of the second half of the Retention Money] which becomes due after the Defects Liability Period has passed and certified in the form of Defects Correction Certificate, is to be made against a Retention Money Guarantee.

At the request of the Contractor, we [insert name of Bank] hereby irrevocably unconditionally undertake to pay you any sum or sums not exceeding in total an amount of Tk. [insert amount in figures] (Taka [insert amount in words]) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor failed to properly correct the defects duly notified in respect of the Supply and Installation of Plant & Equipment.

It is a condition for any claim and payment under this guarantee to be made that the payment of the second half of the Retention Money referred to above must have been received by the Contractor on its account number[insert A/C no] at [name and address of Bank].

This guarantee is valid until [insert the date of validity of Guarantee that being twenty-eight (28) days beyond the Defects Liability Period]. Consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

Warranty Certificate (Form PG5A - 12)

[The Tenderer shall require to fill in this Form in accordance with the instructions indicated. This Certificate should be on the official pad of the Tenderer and should be signed by a person with the proper authority to sign documents.]

[The Tenderer shall include it in its Tender, if so indicated in the ***TDS as stated under ITT Sub Clause 24.2 (r)]***

Invitation for Tender No:	Date:
Tender Package No:	
Tender Lot No. (*when applicable*):	
To: [Name and address of Procuring Entity]	

WHEREAS

We *[insert complete name of Tenderer],*

who are authorized Supplier of *[insert type of goods to be Supplied],* having registered office at *[insert full address of Tenderer's registered office]* do hereby warrants that all the Goods [*insert name and brief description of the Goods*] will be supplied by us and extend our full guarantee and warranty as stated under GCC Clause 42.2 of the General Conditions of Contract with respect to the Goods offered by us under this contract.

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

Name: *[insert complete name(s) of authorized representative(s) of the Tenderer]*
Address: *[insert full address including Fax and e-mail]*
Title: *[insert title]*
Date: *[insert date of signing]*

Section 6.Employer's Requirements

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6.1.1 Scope of Supply of Plant and Installation Services by the Contractor

General:

This section of the document describes basic equipment, sub-assembly, configuration and schedule of Goods and Services which is mandatory requirement to cover and shall be supplied and performed but not limited to implement the complete facility on turnkey basis. The works covered by the Tender/Bid is "Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 05 Nos. New 33/11kV GIS Substation, 02 Nos. 33/11kV GIS Substation (Up-gradation), 02 Nos 33 kV Bay Extension & 33 kV XLPE 1x800 mm2 underground armoured copper cable Double Circuit line with Civil works, and other related works; including automation of the sub-station (SAS) interfacing with the existing SCADA System of Chattogram, on Turnkey Basis under Power Distribution System Development, Chattogram Zone (2nd Phase).. The scope of the plant and services also includes/covers quality assurance, packing for export, insurance & shipment to site, complete construction & installation, jointing, terminating, bonding, earthing, painting, transportation, setting to work, site testing & commissioning of all the equipment necessary for safe operation of the sub-stations along with having the full responsibility for civil works including design and construction of transformer foundations and control building, etc. Moreover, the existing equipment dismantled from the existing substation shall be handed over and deposited to Project Store, Chattogram without any damage as per direction of Project Director or Engineer of this project. Shifting/ Modification of any existing scheme of equipment to new equipment in up gradation work scope shall be deemed included in the scope.

The scope includes the design, manufacture, supply, installation and commissioning of Substation Automation System (SAS) for both 33KV GIS system with provision for interfacing with SCADA System for 05 Nos. New 33/11kV GIS Substation, 02 Nos. 33/11kV GIS Substation (Up-gradation) . 02 Nos. 33/11kV Bay Extension.

The detail requirement is listed in the technical specification and Guaranteed Technical particulars (GTP) in the tender document. The contractor shall remedy all defects during the defect liability period of the Plant & Equipment as per contract.

The contractor is responsible for ensuring that all and any items of work required for the safe efficient and satisfactory completion and functioning of the Plant & Equipment and services. After completing all works of substation if any amount of any item remain excess (as per BOQ & price schedule) handed over to Project Store, Chattogram .

The conceptual layout, general arrangement and single line diagram for the proposed 05 Nos. New 33/11kV GIS Substation, 02 Nos. 33/11kV GIS Substation (Up-gradation), 02 Nos 33 kV Bay Extension are attached in Annex- 9. The GIS/AIS equipment building and control room and probable approach and internal roads have been shown. The arrangement is indicative and the detailed layout design will be prepared and submitted by the EPC Contractor for BPDB's approval. The station layout and equipment rating shall be based on the single line diagram. The Contractor

shall work out an optimum layout based on the requirement and specific features of the manufacturer's product within the constraints of overall dimensions of the plot. The layout and equipment setup shall be optimized in such way as to keep free space, if any, for other purpose and future expansion.

The detailed design arrangement of the equipment shall be the responsibility of the Contractor subject to the approval of the Engineer. The Contractor shall submit all drawings, manuals, designs and calculations for review prior to commencing manufacturing and /or installation works.

Moreover, the contractor shall responsible for Transportation of machinery/equipment to the Project Site including moving the equipment and materials from the designated store as per site requirement and Consignee's advice. All the consumables goods or any equipment/machinery/ materials are required to complete the Plant & Equipment and services shall be the responsibilities of the contractor and all the necessary arrangement for Power, Water, accommodations or any such facilities and tools-tackles, necessary instruments required for erection, installation, testing and commissioning will be supplied/arranged by the contractor within the quoted price. The contractor shall handover all the removable materials/goods at the place within layout plan as instructed by the consignee.

Training at Site:

The Contractor shall provide training on site to the BPDB personnel. The training shall comprise a balanced combination of classroom training and hands on experience, and shall cover all aspects of equipment installation, operation and maintenance. The BPDB personnel will be deputed full time to the Contractor for both class room and on-the-job training.

The Contractor shall provide a program for site training and course synopsis not later than 4 (four) weeks prior to mobilization to sites. The Contractor shall submit to the Purchaser a copy of all classroom material handed out to the trainees.

Seven (03) days local training conducted by the resource person from Manufacturer's factory, expert in providing related training for 8 nos. of purchaser employees (Engineer/ Supervisor/ Technician) in each substation regarding all aspects of Fundamentals/ Basics conception of Descriptions & Functions of Plant /Equipment, Configuration, setting, testing & safe operation of substation for all operation, maintenance and troubleshooting of Substation.

Note: Tenderers shall quote a Firm Turnkey Contract Price for the Plant & Equipment and services as described in Price Schedule and in Section 6, 7, 8 & 9 of this Tender document. If the Tenderer deemed necessary any additional Plant & Equipment and services out of the list of tender schedules for completion of the said Turnkey works and site requirement, contractor shall have to do the additional works. The costs of these additional works are deemed to be included within the quoted price. Tenderer are requested to visit the site to consider all before the submission of the Tender

6.1.1.1 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,
   (c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.
5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
750 square meter (250 Sq. m each floor) three storied Building with four storied foundation (Ground Floor- Height 24'6", 1st Floor- Height-10'6", 2nd Floor- Height-14'6" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per

technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.

10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.

15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power

failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 02 nos. for Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Supply and installation of 02 nos. of Power Transformer 33/11 kV, 20/26 MVA, Dyn11 with all related accessories.

4) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

5) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with accessories as required.

6) Supply and installation of Control room indoor illumination.

7) Supply and installation of Emergency lighting

8) Supply and installation of Fire Fighting equipment and Fire Detection system.

9) Supply and installation of Exhaust Fan (Two nos. in battery room).

10) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in

the GIS substation building.

11) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

12) Supply and installation of AC Distribution Panel, DC Distribution Panel.

13) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

14) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

15) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having single bus 2000A:

a) Incoming Feeders (1250A): 02Nos with PT
b) Outgoing Feeders (1250 A): 02 Nos with PT
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A): 01 Nos.
d) Power Transformer Feeders (1250A): 02Nos with PT
e) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:

a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.
b) Outgoing Feeders with PCM (630A) with PCM: 12 Nos.
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

16) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

17) Supply and installation/ connection of Control Cables

18) Supply and installation of Battery, Ni-Cd as per BOQ.

19) Supply and installation of Battery Charger as per BOQ.

20) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

21) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

22) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

Besides the above others are as follow:

23) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers.

They will be installed on the 2nd floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the 1st of the proposed Control room / substation building with steel structure cable trenches. All the Common Service Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

24) 02 (Two) Nos. new 33/11KV, 20/26MVA, ONAN/ONAF Power Transformers shall be installed in the Substation control room building and shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for power transformers).

25) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

26) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

27) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

28) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

29) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

30) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

31) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided along with the breakers, isolators and earth switches of various feeders as per normal convention.

32) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all

indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

33) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

34) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).

- 33KV 1Cx500mm2 cable connected to 02 (Two) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 02 (two) nos. 33 kV GIS x-former feeder .

- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 20/26 MVA, ONAN/ONAF Power Transformers.
- 0.415 kV, 4CX120 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for Station Auxiliary Transformer Incoming.

- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation. The requisite termination kits are to be supplied and installed.
- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

35) The Scope also includes the design, manufacture, supply, Installation and commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

36) Outdoor lightning protection system for the substation shall be installed.

37) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

38) The Bidder must visit the site and assess the works before submitting his Tender and

will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

39) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.2 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

B. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,
   (c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.
5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
   750 square meter (250 Sq. m each floor) three storied Building with four storied foundation (Ground Floor- Height 24'6", 1st Floor- Height-10'6", 2nd Floor- Height-14'6" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

   1600 square meter (400 Sq. m each floor) Four storied Building with Six storied foundation (All Floor- Height-10'6") as per price schedule for office.

   Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

   Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.
10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.
15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire

extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) The transformer foundation should be 20/26MVA for future provision.

22) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 02 nos. for Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Supply and installation of 02 nos. of Power Transformer 33/11 kV, 20/26 MVA, Dyn11 with all related accessories.

4) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

5) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with accessories as required.

6) Supply and installation of Control room indoor illumination.

7) Supply and installation of Emergency lighting

8) Supply and installation of Fire Fighting equipment and Fire Detection system.

9) Supply and installation of Exhaust Fan (Two nos. in battery room).

10) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in the GIS substation building.

11) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

12) Supply and installation of AC Distribution Panel, DC Distribution Panel.

13) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

14) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

15) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having single bus 2000A:

f) Incoming Feeders (1250A): 02Nos with PT
g) Outgoing Feeders (1250 A): 02 Nos with PT
h) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A): 01 Nos.
i) Power Transformer Feeders (1250A): 02Nos with PT
j) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:

a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.
b) Outgoing Feeders with PCM (630A) with PCM: 12 Nos.
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

16) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

17) Supply and installation/ connection of Control Cables

18) Supply and installation of Battery, Ni-Cd as per BOQ.

19) Supply and installation of Battery Charger as per BOQ.

20) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

21) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

22) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

<u>Besides the above others are as follow:</u>

23) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers. They will be installed on the 1st floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the Ground floor of the proposed Control room / substation building with steel structure cable trenches. Portion of Ground floor may be used as office room of the sub-station building. All the Common Service

Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

24) 02 (Two) Nos. new 33/11KV, 20/26MVA, ONAN/ONAF Power Transformers shall be installed in the Substation control room building and shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for power transformers).

25) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

26) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

27) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

28) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

29) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

30) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

31) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided along with the breakers, isolators and earth switches of various feeders as per normal convention.

32) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

33) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

34) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- 33KV 1Cx500mm2 cable connected to 02 (Two) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 02 (two) nos. 33 kV GIS x-former feeder .
- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 20/26 MVA, ONAN/ONAF Power Transformers.

- 0.415 kV, 4CX120 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for Station Auxiliary Transformer Incoming.

- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation. The requisite termination kits are to be supplied and installed.

- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

35) The Scope also includes the design, manufacture, supply, Installation and commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

36) Outdoor lightning protection system for the substation shall be installed.

37) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

38) The Bidder must visit the site and assess the works before submitting his Tender and will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to

obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

39) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.3 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

C. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,

(c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.
5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
500 square meter (250 Sq. m each floor) two storied Building with four storied foundation (Ground Floor- Height 10'5", 1st Floor- Height-14'5" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.

10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.

15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) The transformer foundation should be 20/26MVA for future provision.

23) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls,

roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 04 nos. for Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

4) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with accessories as required.

5) Supply and installation of Control room indoor illumination.

6 Supply and installation of Emergency lighting

7) Supply and installation of Fire Fighting equipment and Fire Detection system.

8) Supply and installation of Exhaust Fan (Two nos. in battery room).

9) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in the GIS substation building.

10) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

11) Supply and installation of AC Distribution Panel, DC Distribution Panel.

12) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

13) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

14) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having single bus 2000A:

k) Incoming Feeders (1250A): 02Nos with PT
l) Outgoing Feeders (1250 A): 04 Nos with PT
m) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A): 01 Nos.
n) Power Transformer Feeders (1250A): 02Nos with PT
o) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:

a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.
b) Outgoing Feeders with PCM (630A) with PCM: 8 Nos.
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

15) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

16) Supply and installation/ connection of Control Cables

17) Supply and installation of Battery, Ni-Cd as per BOQ.

18) Supply and installation of Battery Charger as per BOQ.

19) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

20) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

21) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

Besides the above others are as follow:

22) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers. They will be installed on the 1st floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the Ground floor of the proposed Control room / substation building with steel structure cable trenches. Portion of Ground floor may be used as office room of the sub-station building. All the Common Service Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

23) 02 (Two) Nos. Existing 33/11KV,16/20MVA, ONAN/ONAF Power Transformers shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for

power transformers).
26) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

24) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

25) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

26) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

27) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

28) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

29) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided along with the breakers, isolators and earth switches of various feeders as per normal convention.

30) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

31) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

32) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- 33KV 1Cx500mm2 cable connected to 04 (Four) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under

this scope).

- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 02 (two) nos. 33 kV GIS x-former feeder .
- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 16/20MVA, ONAN/ONAF Power Transformers.
- 0.415 kV, 4CX185 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for Station Auxiliary Transformer Incoming.

- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation.The requisite termination kits are to be supplied and installed.

- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

33) The Scope also includes the design, manufacture, supply, Installation and commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

34) Outdoor lightning protection system for the substation shall be installed.

35) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

36) The Bidder must visit the site and assess the works before submitting his Tender and will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

37) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.4 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

D. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,
   (c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.

5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
500 square meter (250 Sq. m each floor) two storied Building with four storied foundation (Ground Floor- Height 10'5", 1st Floor- Height-14'5" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.

10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.

15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) The transformer foundation should be 20/26MVA for future provision.

23) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 02 nos. for

Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Supply and installation of 02 nos. of Power Transformer 33/11 kV, 20/26 MVA, Dyn11 with all related accessories.

4) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

5) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with accessories as required.

6) Supply and installation of Control room indoor illumination.

7) Supply and installation of Emergency lighting

8) Supply and installation of Fire Fighting equipment and Fire Detection system.

9) Supply and installation of Exhaust Fan (Two nos. in battery room).

10) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in the GIS substation building.

11) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

12) Supply and installation of AC Distribution Panel, DC Distribution Panel.

13) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

14) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

15) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having single bus 2000A:

p) Incoming Feeders (1250A): 02Nos with PT
q) Outgoing Feeders (1250 A): 02 Nos with PT
r) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A): 01 Nos.
s) Power Transformer Feeders (1250A): 02Nos with PT
t) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:

a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.

b) Outgoing Feeders with PCM (630A) with PCM: 8 Nos.

c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

16) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

17) Supply and installation/ connection of Control Cables

18) Supply and installation of Battery, Ni-Cd as per BOQ.

19) Supply and installation of Battery Charger as per BOQ.

20) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

21) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

22) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

Besides the above others are as follow:

23) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers. They will be installed on the 1st floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the Ground floor of the proposed Control room / substation building with steel structure cable trenches. Portion of Ground floor may be used as office room of the sub-station building. All the Common Service Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

24) 02 (Two) Nos. new 33/11KV,16/20MVA, ONAN/ONAF Power Transformers shall be installed in the Substation control room building and shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for power transformers).

25) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

26) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and

battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

27) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

28) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

29) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

30) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

31) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided along with the breakers, isolators and earth switches of various feeders as per normal convention.

32) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

33) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

34) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- 33KV 1Cx500mm2 cable connected to 02 (Two) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 02 (two) nos. 33 kV GIS x-former feeder .
- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 16/20MVA, ONAN/ONAF Power Transformers.
- 0.415 kV, 4CX185 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for

Station Auxiliary Transformer Incoming.

- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation.The requisite termination kits are to be supplied and installed.
- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

35) The Scope also includes the design, manufacture, supply, Installation and commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

36) Outdoor lightning protection system for the substation shall be installed.

37) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

38) The Bidder must visit the site and assess the works before submitting his Tender and will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

39) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.5 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

E. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,
   (c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.
5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
   500 square meter (250 Sq. m each floor) two storied Building with four storied foundation (Ground Floor- Height 10'5", 1st Floor- Height-14'5" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.

10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.

15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) The transformer foundation should be 20/26MVA for future provision.

23) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 02 nos. for Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV

MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Supply and installation of 02 nos. of Power Transformer 33/11 kV, 20/26 MVA, Dyn11 with all related accessories.

4) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

5) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with accessories as required.

6) Supply and installation of Control room indoor illumination.

7) Supply and installation of Emergency lighting

8) Supply and installation of Fire Fighting equipment and Fire Detection system.

9) Supply and installation of Exhaust Fan (Two nos. in battery room).

10) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in the GIS substation building.

11) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

12) Supply and installation of AC Distribution Panel, DC Distribution Panel.

13) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

14) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

15) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having single bus 2000A:

u) Incoming Feeders (1250A): 02Nos with PT
v) Outgoing Feeders (1250 A): 02 Nos with PT
w) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A): 01 Nos.
x) Power Transformer Feeders (1250A): 02Nos with PT
y) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:

a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.
b) Outgoing Feeders with PCM (630A) with PCM: 8 Nos.
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

16) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

17) Supply and installation/ connection of Control Cables

18) Supply and installation of Battery, Ni-Cd as per BOQ.

19) Supply and installation of Battery Charger as per BOQ.

20) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

21) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

22) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

Besides the above others are as follow:

23) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers.They will be installed on the 1st floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the Ground floor of the proposed Control room / substation building with steel structure cable trenches. Portion of Ground floor may be used as office room of the sub-station building. All the Common Service Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

24) 02 (Two) Nos. new 33/11KV,20/26MVA, ONAN/ONAF Power Transformers shall be installed in the Substation control room building and shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for power transformers).
26) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

25) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

26) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

27) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

28) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

29) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

30) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided along with the breakers, isolators and earth switches of various feeders as per normal convention.

31) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

32) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

33) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- 33KV 1Cx500mm2 cable connected to 02 (Two) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 02 (two) nos. 33 kV GIS x-former feeder .
- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 16/20MVA, ONAN/ONAF Power Transformers.
- 0.415 kV, 4CX185 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for Station Auxiliary Transformer Incoming.
- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation.The requisite termination kits are to be supplied and installed.

- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

34) The Scope also includes the design, manufacture, supply, Installation and commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

35) Outdoor lightning protection system for the substation shall be installed.

36) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

37) The Bidder must visit the site and assess the works before submitting his Tender and will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

38) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.6 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

F. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,
   (c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.
5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
   840 square meter (280 Sq. m each floor) three storied Building with four storied foundation (Ground Floor- Height 24'6" for Transformer, 1st Floor- Height-10'6" for Cable room, 2nd Floor- Height-14'6" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

   Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.

10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.

15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building

- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) The transformer foundation should be 20/26MVA for future provision.

22) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 02 nos. for Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Supply and installation of 02 nos. of Power Transformer 33/11 kV, 20/26 MVA, Dyn11 with all related accessories.

4) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

5) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with

accessories as required.

6) Supply and installation of Control room indoor illumination.

7) Supply and installation of Emergency lighting

8) Supply and installation of Fire Fighting equipment and Fire Detection system.

9) Supply and installation of Exhaust Fan (Two nos. in battery room).

10) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in the GIS substation building.

11) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

12) Supply and installation of AC Distribution Panel, DC Distribution Panel.

13) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

14) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

15) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having single bus 2000A:

z) Incoming Feeders (1250A): 02Nos with PT
aa) Outgoing Feeders (1250 A): 05 Nos with PT
bb) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A): 02 Nos.
cc) Power Transformer Feeders (1250A): 03Nos with PT
dd) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:

a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.
b) Outgoing Feeders with PCM (630A) with PCM: 18 Nos.
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

16) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

17) Supply and installation/ connection of Control Cables

18) Supply and installation of Battery, Ni-Cd as per BOQ.

19) Supply and installation of Battery Charger as per BOQ.

20) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

21) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

22) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

Besides the above others are as follow:

23) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers. They will be installed on the 1st floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the Ground floor of the proposed Control room / substation building with steel structure cable trenches. Portion of Ground floor may be used as office room of the sub-station building. All the Common Service Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

24) 03 (Two) Nos. new 33/11KV,20/26MVA, ONAN/ONAF Power Transformers shall be installed in the Substation control room building and shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for power transformers).

25) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

26) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

27) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

28) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

29) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

30) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

31) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided along with the breakers, isolators and earth switches of various feeders as per normal convention.

32) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

33) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

34) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- 33KV 1Cx500mm2 cable connected to 05 (Five) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 03(three) nos. 33 kV GIS x-former feeder .
- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 16/20MVA, ONAN/ONAF Power Transformers.
- 0.415 kV, 4CX185 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for Station Auxiliary Transformer Incoming.

- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation.The requisite termination kits are to be supplied and installed.
- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

35) The Scope also includes the design, manufacture, supply, Installation and

commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

36) Outdoor lightning protection system for the substation shall be installed.

37) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

38) The Bidder must visit the site and assess the works before submitting his Tender and will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

39) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.7 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

G. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/Erection, Construction, Testing and Commissioning, (dismantling if necessary) and so on of the following works are the scope of works:

1) Landscaping work and gardening of the whole sub-station area. Bidder shall submit the layout of the whole substation area of landscaping work for approval.

2) Construction of cable trenches including cable rack for power cable and control cable (where required);
   (a) Within the switch yard area,
   (b) Switch yard area to control room building,
   (c) For 33KV & 11kV Cable lying inside Substation Compound.

3) Construction of main entrance gate and side gate with aesthetic view. Construction/ installation of Substation NAME PLATE/ SIGN BOARD. A digital sign board (electronic sign board) to be fixed on the top of the main entrance gate.

4) Construction of R.C.C base foundations for power transformers and all others equipment & Structure as required.
5) Construction of Guard post 10 square meter adjacent to the main gate of the substation.

6) Design & Construction of new GIS Substation Building:
   750 square meter (250 Sq. m each floor) three storied Building with four storied foundation (Ground Floor- Height 24'6" for Transformer, 1st Floor- Height-10'6" for Cable room, 2nd Floor- Height-14'6" for Control Room) as per price schedule for the substation control room, store, cable room, etc. including roof lime terracing, door, window, toilet etc.

   Electrification of the whole substation area is within the scope. In control room high quality tiles shall be installed in floor. For this new Sub-station, in the control room building & office building having facilities of wash basin, bath shower towel rod, soap case, auzo wash, glass rack, looking mirror, pan fitting with low-down, swan neck pillar cock, extra long bib cock, interior walls and floor finished by tiles, underground water reservoir tank and all allied civil works deemed necessary are included in the Bid complete in all respect.

   Overhead water tank 2X500 liter on the top of the control room building & office building, underground water reservoir (tank), water lifting pump, suction pump and portable water supply system complete in all respect [Design shall be based on use of 20 persons per day for overhead water tank] Construction of septic tank, soak well, inspections pits, sewerage piping by PVC 6 inches dia. Pipe, toilet/ bathroom/lavatory located.

7) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

8) Construction of approach road from the main gate to the Substation building entrance and internal road for whole sub-station campus area and parking area (shall be carpeting/RCC flooring) as required. All roads shall be of concrete road as per technical specification. The other roads main and approach RCC road shall be min 6 meters wide. Road in front of transformer shall be min 6.0 meters wide RCC road.

9) Properly insulated False Ceiling of Control room, office, suitable for Air conditioning system.

10) Construction of drainage, sanitary system for whole sub-station area.

11) Supply and installation of Operation Key Board, Al/ Steel frame front cover glass with locking device, dust proof.

12) Supply and installation of Chain link fencing with gate for Power Transformer & Station transformer if required. Earthing for fencing required.

13) Supply of two operator working table, Steel made with extra glass on the top, and two nos. of wheel based revolving chair & ten nos. visitor chair, curtain (venetian blind) of window in the control room.

14) Supply of Steel File Cabinet (four drawers), Steel Almirah for record keeping in the control room.

15) Contractor shall supply and install 32 inch LED Television, 01 set of Desktop Computer with Printer, Scanner and complete furniture for the substation control room & office building.

16) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

17) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.

18) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

19) Supply and installation of decorative LED street lights after every 15 meter interval (if required). LED Street lighting has the feature of Multiple Mounting Options Available, Rugged Precision Cast Aluminum Housing, Perforated Air Flow Venting, High Surface Area Extruded Aluminum Heat Sinks, High Output White LED Diode, Decorative Lens Cover Seals

the Electrical/Optical Chamber to IP66, Electronic Driver. The pole shall be stylish, non-corrosive, easy to install and have longer service life.

20) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

21) The scope shall include fire extinguishing equipment such as Trolley mounted fire extinguisher with foam type chemical for B type Fire (15kg), Wall mounted fire extinguisher with dry type chemical for A, B and C type Fire (5kg) and Wall mounted fire extinguisher with CO2 type chemical for A, B and C type Fire (2kg), Fire detection unit & Alarm system. The scope shall also include Air conditioning Equipment for substation.

22) The transformer foundation should be 20/26MVA for future provision.

22) Service pile load test to be done for the construction of sub-station & office building (where as required as per soil condition)

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS :

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of at least but not limited to the following works are the scope of works:

1) Supply and installation of 33kV Indoor GIS - 02 nos. for Incoming Feeder, 02 nos. for Outgoing Feeder, 02 nos. for Power Transformer Incoming Feeder, 01 nos. Incoming feeder for Station Auxiliary X- former and 01 nos. for Sectionalizer (Bus Coupler with riser) and all others accessories complete in all respect.

2) Supply and installation of 01 nos. Station use 33/0.415 KV, 250 KVA Auxiliary transformer, ONAN, Dyn-11 to be connected with 33kV GIS panel including 0.415 kV MCCB, Power cable, cable terminating kits with structures, etc complete in all respect.

3) Installation of 02 nos. of Existing Power Transformer 33/11 kV, 01(one) no. 16/20 MVA & 01(one) no. 20/26 MVA, Dyn11 with all related accessories.

4) Supply and installation of Switch yard grounding materials for required sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm during dry season.

5) Supporting steel/RCC structure for connecting the XLPE Power Cable (HV/LV) with accessories as required.

6) Supply and installation of Control room indoor illumination.

7) Supply and installation of Emergency lighting

8) Supply and installation of Fire Fighting equipment and Fire Detection system.

10) Supply and installation of Exhaust Fan (Two nos. in battery room).

11) Supply and installation of Split type Air conditioner (At least forty eight thousand BTU per hr. capacity including MCB, switch, male female plug socket complete) - 04 nos. in the GIS substation building.

12) Supply & installation of GIS Panel for 33kV power transformer, Line feeders of the proposed 33kV & 11KV (GIS) Circuits to be installed in the control room building.

13) Supply and installation of AC Distribution Panel, DC Distribution Panel.

14) Supply and installation of Separate AC distribution Box, wall mounting for control room internal & external illumination switching, extra power supply arrangement for testing purpose, different operation and maintenance use.

15) Supply and installation of switching boards to be installed in each room for functioning of fans, lights, Air conditioner etc.

16) Supply and installation of 33kV indoor Type GIS & 11kV indoor Type GIS as describe below:

Indoor 33 KV GIS Panels having Double bus 2000A:
ee) Incoming Feeders (2500A): 02Nos with PT
ff) Outgoing Feeders (1250 A): 17 Nos with PT
gg) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (3150 A): 01 Nos.
hh)Power Transformer Feeders (1250A): 02Nos with PT
ii) Station Auxiliary Transformer Feeders (1250A) : 01 Nos .

Indoor 11 KV GIS Panels having single bus 2500A:
a) Incoming Feeders with PCM (2500 A) with PT: 02 Nos.
b) Outgoing Feeders with PCM (630A) with PCM: 10 Nos.
c) Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A): 01Nos.

17) Supply and installation/ connection of 33kV, 11kV Power Cable, XLPE for all 33kV or 11kV line feeders and transformers feeder including cable termination (Outdoor & Indoor) as required.

18) Supply and installation/ connection of Control Cables

19) Supply and installation of Battery, Ni-Cd as per BOQ.

20) Supply and installation of Battery Charger as per BOQ.

21) Supply and lying of Rubber pad to be laid in front of the SWITCHGEAR Panels.

22) 05(Five) Sets of As-built drawings together with operation and maintenance Manual, relevant IEC standards of the installed equipment shall be submitted to the Directorate of Design & Inspection -2, BPDB, Dhaka for reviewing within 15 days of commissioning of substation .

23) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

Besides the above others are as follow:

24) All the 33 KV & 11kV Switchgears will be of Gas Insulated type with circuit breakers. They will be installed on the 1st floor of the proposed Control room / substation building. All 33KV and 11KV cable shall be accommodated in the Ground floor of the proposed Control room / substation building with steel structure cable trenches. Portion of Ground floor may be used as office room of the sub-station building. All the Common Service Facility areas- Reception, Waiting/ Common Space, Rest/Wash rooms, etc shall be installed in floor. Every floor shall be designed with Natural Ventilation system. There shall be adequate space to both end of 33kV GIS panel & 11 kV GIS panel for future extension.

25) 02 (Two) Nos. Existing 33/11KV, Power Transformers shall be installed in the Substation control room building and shall be connected to the 33 kV switchgear and 11 kV switchgear panels (described above) and by single core XLPE cable of required voltage and size. The volume of the transformers shall be such that these are accommodated in the space available by keeping safe electrical clearance. Both the new Transformers are to be identical and from the same manufacturer. Provision for running the transformers in parallel is to be provided. Tap Changer Control panel with AVR relay, Auto/Manual and Master/ Follower control switch. (02 panel for power transformers).
26) Fire-wall shall be constructed between one and the next power. Adequate free air passage space shall be maintained.

27) 01 (two) No. 33/0.415KV, 250KVA Station Transformers (Oil type) will be installed separately beside Power Transformer by 33 KV cable terminations. The LV sides of the station transformer will be connected to the LV A/C distribution Panel by LV cables of appropriate size. Single sources of D/C supply with 01 set of 110 V battery (Ni-Cd) and battery charger shall be installed and connected to the D/C distribution panel by LV cables of appropriate size.

28) The indoor 33KV XLPE copper cables will be connected to 33KV GIS panel by requisite cable termination kit.

29) The indoor 11KV XLPE copper cables will be connected to 11KV GIS panel by requisite cable termination kit. The indoor terminations of the 11KV cables with the 11 KV switchgear panel will be as per arrangement provided there. All the 33kV and 11kV cables shall be armored and cu-wire screened.

30) The outdoor cable terminations of the 33 KV cables (where required) will be heat shrink type and supported by steel structure. In the same way the 11KV cables outdoor type terminations will be heat shrink type being supported by steel structure.

31) The conventional protections to transformer feeders, line feeders and bus coupler are to be provided. However, total protection scheme is to be implemented on approval from BPDB Authority. Meters for monitoring three phase Current and voltage are to be installed in each panel.

32) All 33KV & 11KV panels (except the bus couplers) are to be provided with separate high class Digital energy meter of 0.2 class having provision of remote communication facilities. Both mechanical and electrical inter locks are to be provided

along with the breakers, isolators and earth switches of various feeders as per normal convention.

33) Grounding mesh of copper conductor of requisite earth resistance (shall be <0.50ohm) will be installed for grounding the neutrals of the power transformers, station transformers, their bodies, the lightning arrestor sets, the steel supporting structure, all indoor & outdoor panels etc. The grounding system is to be implemented on approval of the design from BPDB Authority.

34) AC and DC distribution Panels, Battery Sets with battery chargers shall be accommodated on the same floor of 33 kV and 11 kV switchgear panels.

35) The 33 KV incoming feeders (from source substation/grid) shall be connected to the 33 KV incoming GIS panel. The 11 KV sides of 33/11KV power transformers will then be connected (by 11KV XLPE cables) to the 11 KV incoming GIS Panel.

- 33KV 3x1Cx800mm2 cable per phase connected to 02 (Two) nos. 33 kV GIS Incoming Breaker (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- 33KV 1Cx500mm2 cable connected to 17 (Seventeen) nos. 33 kV GIS Outgoing feeder (Supply of Cable, Indoor and outdoor termination kits and connection work is under this scope).
- Connection from 33kV GIS (Transformer feeder) to power transformer will be made by 1Cx 500 mm2 XLPE Cu cable for 02 (two) nos. 33 kV GIS x-former feeder .
- 11KV incoming connection from the transformer to the breaker will be made by 2x1Cx630 mm2 XLPE Copper Cable for 33/11KV, 20/26MVA, ONAN/ONAF Power Transformers.
- 0.415 kV, 4CX185 mm2 XLPE PVC (Cu) Cable for Station Auxiliary Transformer and 33 kV, 3CX95mm2 XLPE Copper Cable with Indoor and outdoor termination kits for Station Auxiliary Transformer Incoming.

- Transformer Neutral will also be connected to ground by copper cable of 2X1CX185 mm2 with 03 (Three) Nos. of Electrode (Round Bar) of 16 mm Dia with 04 (Four) Meter Length Each and Length of the electrode will be decided as per Design calculation.The requisite termination kits are to be supplied and installed.
- The 11KV outgoing feeder of the substation from the 11KV outgoing breaker shall be connected by 3CX185 mm2 XLPE Cable and connect through underground up to the outgoing SPC Feeder pole line (adjacent to proposed boundary wall).

Indoor and Outdoor all 33kV & 11 kV Termination is in the contractor's Scope.

36) The Scope also includes the design, manufacture, supply, Installation and commissioning of Substation Automation System (SAS) for both 33KV GIS & 11KV GIS system with provision for interfacing with SCADA System.

37) Outdoor lightning protection system for the substation shall be installed.

38) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and

maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka.

39) The Bidder must visit the site and assess the works before submitting his Tender and will carefully examine the tender requirements and to determine the existing conditions, facilities and limitations. Tenderer shall have make all necessary arrangement to carry out the Contract if awarded. Any neglect to delay or failure on the part of the tenderer to obtain reliable information upon the foregoing or any matter effecting the work and completion period shall not relieve the successful tenderer of his responsibilities, risks or liabilities until final acceptance of the Supply of Goods and Related Services in case of award of the contract.

40) Any additional works not covered above but necessary for the functioning of the system & required as per specification to be incorporated by the Tenderer. The items of minor nature, which is not mentioned, shall be incorporated by the bidder.

Indicative Layout & Single line diagram in Annex-1.

6.1.1.8 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and commissioning and so on of the following works are the scope of works:

1) Earth filling, Land escaping, Leveling, Dressing of the proposed switchyard area. Employer will provide all lands only and contractor will fill it by sand (if necessary) up to ground level. Soil testing for soil resistivity and soil bearing capacity before designing, final leveling, consolidation, surfacing and compaction of related switchyard area with crushed rock (where required) to cater for the ultimate development of the substation.

2) Construction of cable trenches for control cable:
   (a) Within the switch yard area
   (b) Switch yard area to control room building

3) Construction of R.C.C foundations for, switch yard tower and all others equipment & Structure as required.
4) Supply of gravel and finishing the Switchyard surface by the gravel to the switchyard.

5) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

6) Extension of control room building (35 x 2) Sq-meter two storied. Construction of drainage, sanitary system for Control Room Extension area.

7) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

8) Dismantling work as per Price Schedule, BOQ & field requirement.

9) Supply and installation of office room, Control room indoor illumination. Lighting levels within the building must be generally designed to meet the requirements of IEC Standards, and in particular, meet the following specific lighting levels:

- 400 lux between rows at switchgear front panels within the Control Building;
- 400 lux at the front of control panel within the Control Building;
- 160 lux to the rear of switchgear in the Control building
- 160 lux adjacent to the Battery Storage, Load Management Equipment, AC and DC panels

10) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls,

roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

1) Supply and installation of 4(**four) nos. 33kV Line Feeders** comprising: 33kV VCB, CT, DS, LA, Control cable, Cable termination kit, PCM Panel, Supporting structures etc.

3) Supply and installation of Switch yard shielding materials.

4) Supply and installation of Switch yard grounding materials for extended sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm.

8) Supply and installation/ connection of Control Cables.

9) 3 (Three) sets of As-built drawings together with operation and maintenance manual, **relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka**. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, **relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB.**

10) The Bidder must visit the site and assess the works before tender submission.

12) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid

6.1.1.9 Scope for Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and commissioning and so on of the following works are the scope of works:

1) Earth filling, Land escaping, Leveling, Dressing of the proposed switchyard area. Employer will provide all lands only and contractor will fill it by sand (if necessary) upto ground level. Soil testing for soil resistivity and soil bearing capacity before designing, final leveling, consolidation, surfacing and compaction of related switchyard area with crushed rock (where required) to cater for the ultimate development of the substation.

2) Construction of cable trenches for control cable:
   (a) Within the switch yard area
   (b) Switch yard area to control room building

3) Construction of R.C.C foundations for, switch yard equipment & Structure as required.
4) Supply of gravel and finishing the Switchyard surface by the gravel to the switchyard.

5) Soil testing for soil resistivity and soil bearing capacity before designing final leveling of Control room area.

6) Supply and construction of Power cable trench and control cable rack inside the Ground floor of the substation building. Proper fire and water proof sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, fire proof etc.

7) Dismantling work as per Price Schedule, BOQ & field requirement.

8) All civil works and necessary indoor & outdoor lighting [Energy efficient (LED) and automated] are required within the scope of the Tender. The substation control room building shall have the emergency automated dc lighting system in case of power failure.

NOTE: All doors & windows work to be finished by aluminum frame and high quality transparent 6 mm thick glasses. Both indoor & outdoor surface finishing works of walls, roof etc, to be synthetic high quality plastic paint and moisture proof snowcem respectively and treatment to be made by lime terracing for rain water leakage proof of the roof.

B. SUB-STATION / ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

1) Supply and installation of 2(**Two) nos. 33kV Line Feeders** comprising: 33kV VCB, CT, DS, LA, Control cable, Cable termination kit, PCM Panel, Supporting structures etc.

2) Supply and installation of Switch yard shielding materials.

3) Supply and installation of Switch yard grounding materials for extended sub-station area and equipment to be installed. Earth resistance of the substation shall be less than 0.5ohm.

4) Supply and installation/ connection of Control Cables.

5) 3 (Three) sets of As-built drawings together with operation and maintenance manual, **relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka**. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, **relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB.**

6) The Bidder must visit the site and assess the works before tender submission.

7) Supply and installation of switching boards to be installed at switchyard for functioning of lights etc.

8) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid

6.2 Bill of Quantities (BOQ)

1. All the items mentioned in the BOQ (as follows) shall be quoted in the respective format of the price schedule, otherwise bid will be rejected.
2. Schedule No: 3 & 5 is applicable for total price of all Substations (Not for individual substation).
3. Tenderer shall quote a Firm Turnkey Contract Price for the Supply and Related Services as described in Price Schedule according to Section 6, Section 7 & Section 8 of this Tender document. If the Tenderer deemed necessary any additional

machineries/equipment/ materials / Supply and Related Services out of the list of tender Price Schedule for completion of the said Turnkey basis works (Supply and Related Services), contractor shall have to do the additional works (Supply and Related Services) without any additional cost. The costs of these additional works (Supply and Related Services) are deemed to be included within the quoted price.

4. Individual sub-station Bill of Quantity (BoQ) as follows:

6.1.2.1 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Chokbazar New) at S&D-Stadium, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	**2**	**3**	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
	housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .		
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 5 Set (1 set =03 Nos).	Lot	1
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.		
	GIS cubicles Outgoing Feeders (630 A) -12 Nos.		
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2
5	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
7	Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 415 volts, output DC 110 - 150 volts including all	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
	accessories.		
8	a)Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories and	Set	1
	b)DC Distribution Panel including all accessories.	Set	1
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter. Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.	Lot	1
10	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 300 meter.	Lot	1
11	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode. a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.	Lot	1
16	Supply of Station type 11 kV Surge Arrester including all accessories- 14 Set (1 set =03 Nos).	Lot	1
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1
18	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
19	Outdoor and Indoor Lighting System.	Lot	1

Line Item No	Description of Item	Quantity	
1	2	3	
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
21	Supply of **Fire Detection** (Smoke Detection & alarm System) **& Fire Fighting Equipment** a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
22	**Civil Works.**	Lot	1
(a)	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Three Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	750
(c)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(d)	Road (approach including internal road & walkway etc).	Lot	1
(e)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(f)	Tree plantation, gardening and beautification etc.	Lot	1
(g)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
23	Installation, Testing, Commissioning of all Equipment.	Lot	1
24	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.1.1.2 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Indoor Type GIS (Korbanigonj New) at S&D-Pathorghata, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
	Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .		
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 5 Set (1 set =03 Nos).	Lot	1
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.		
	GIS cubicles Outgoing Feeders (630 A) -12 Nos.		
4	Supply of 33/11 kV, 20/26MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2
5	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
7	Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 415	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
	volts, output DC 110 - 150 volts including all accessories.		
8	a) Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories and DC Distribution Panel including all accessories.	Set	1
	b) DC Distribution Panel including all accessories.	Set	1
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter.	Lot	1
	Supply of 1C×500sq. mm XLPE (Cu) Cable for 33kV Outgoing feeder as per requirement. As per field requirement but not less than 480 meter.		
10	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 300 meter.	Lot	1
11	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1
	(a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.		
16	Supply of Station type 11 kV Surge Arrester including all accessories- 14 Set (1 set =03 Nos).	Lot	1
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1

Line Item No	Description of Item	Quantity	
1	2	3	
18	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
19	Outdoor and Indoor Lighting System.	Lot	1
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
21	Supply of **Fire Detection** (Smoke Detection & alarm System) **& Fire Fighting Equipment** a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
22	**Civil Works.**	Lot	1
(a)	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Three Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	750
(c)	**Four Storied Office Building :** Including required rooms for staffs , O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting and other related items etc. (If required Dismantling, Demolishing).	Sqm	1600
(d)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(e)	Road (approach including internal road & walkway etc).	Lot	1
(f)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(g)	Tree plantation, gardening and beautification etc.	Lot	1
(h)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
23	Installation, Testing, Commissioning of all Equipment.	Lot	1
24	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.1.1.3 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x16/20 MVA Regular Type GIS (Hathajari New) at S&D-Hathajari, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT-4 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 9 Set (1 set =03 Nos).	Lot	1
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.		
	GIS cubicles Outgoing Feeders (630 A) -8 Nos.		
4	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
5	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
6	Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 415 volts, output DC 110 - 150 volts including all accessories.	Set	2
7	Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories and DC Distribution Panel including all accessories.	Set	1
8	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter. Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Outgoing Feeder. As per field requirement but not less than 960 meter. Supply of 33kV 1C×800 sq.mm XLPE (Cu) Cable as required for Incoming Feeder. As per field requirement but not less than 480 meter.	**Lot**	1
9	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 420 meter.	Lot	1
10	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
11	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 640 meter.	Lot	1
12	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
13	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
14	Supply of all material for Grounding System, Earthing mesh with earthling electrode. (a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.	Lot	1

Line Item No	Description of Item	Quantity	
1	2	3	
15	Supply of Station type 11 kV Surge Arrester including all accessories- 10 Set (1 set =03 Nos).	Lot	1
16	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1
17	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
18	Outdoor and Indoor Lighting System.	Lot	1
19	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
20	Supply of **Fire Detection** (Smoke Detection & alarm System) **& Fire Fighting Equipment** a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
21	**Civil Works.**	Lot	1
(a)	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Two Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	500
(c)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(d)	Road (approach including internal road & walkway etc).	Lot	1
(e)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(f)	Tree plantation, gardening and beautification etc.	Lot	1
(g)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
22	Installation, Testing, Commissioning of all Equipment.	Lot	1
23	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.1.2.4 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Sitakundu, Fokirhat New) at S&D-Barobkundo, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 3150 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 7 Set (1 set =03 Nos).	Lot	1
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT -2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.		
	GIS cubicles Outgoing Feeders (630 A) -12 Nos.		
4	Supply of 33/11 kV, 20/26 MVA ONAN/ONAF Power Transformer (Outdoor type) with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2

Line Item No	Description of Item	Quantity	
1	2	3	
5	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
7	Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 415 volts, output DC 110 - 150 volts including all accessories.	Set	1
8	a) Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories.	Set	1
	b) DC Distribution Panel including all accessories.	Set	1
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter.	**Lot**	1
	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Outgoing Feeder. As per field requirement but not less than 480 meter.		
	Supply of 33kV 1C×800 sq.mm XLPE (Cu) Cable as required for Incoming Feeder. As per field requirement but not less than 480 meter.		
10	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 420 meter.	Lot	1
11	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1
	(a) Supply of grounding copper conductor (As per scope of works and technical Specification).		
	(b) Supply of Grounding copper rod (Earthing		

Line Item No	Description of Item	Quantity	
1	2	3	
	electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.		
16	Supply of Station type 11 kV Surge Arrester including all accessories- 14 Set (1 set =03 Nos).	Lot	1
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1
18	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
19	Outdoor and Indoor Lighting System.	Lot	1
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
21	Supply of **Fire Detection** (Smoke Detection & alarm System) **& Fire Fighting Equipment** a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
22	**Civil Works.**	Lot	1
(a)	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Two Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	500
(c)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(d)	Road (approach including internal road & walkway etc).	Lot	1
(e)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(f)	Tree plantation, gardening and beautification etc.	Lot	1
(g)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
23	Installation, Testing, Commissioning of all Equipment.	Lot	1
24	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.2.1.5 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 2x20/26 MVA Regular Type GIS (Nasirabad Boys New) at S&D-Khulshi, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT-2 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 7 Set (1 set =03 Nos).	Lot	1
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT -2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)-1 No.		
	GIS cubicles Outgoing Feeders (630 A) -12 Nos.		
4	Supply of 33/11 kV, 20/26 MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	2
5	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
7	Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 415 volts, output DC 110 - 150 volts including all accessories.	Set	1
8	a)Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories .	Set	1
	b)DC Distribution Panel including all accessories.	Set	1
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 210 meter. Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Outgoing Feeder. As per field requirement but not less than 480 meter.	**Lot**	1
10	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 420 meter.	Lot	1
11	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 960 meter.	Lot	1
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode. (a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.	Lot	1
16	Supply of Station type 11 kV Surge Arrester including all accessories- 14 Set (1 set =03 Nos).	Lot	1

Line Item No	Description of Item	Quantity	
1	2	3	
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1
18	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
19	Outdoor and Indoor Lighting System.	Lot	1
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
21	Supply of **Fire Detection** (Smoke Detection & alarm System) **& Fire Fighting Equipment** a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
22	**Civil Works.**	Lot	1
(a)	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Two Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	500
(c)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(d)	Road (approach including internal road & walkway etc).	Lot	1
(e)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(f)	Tree plantation, gardening and beautification etc.	Lot	1
(g)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
23	Installation, Testing, Commissioning of all Equipment.	Lot	1
24	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.1.2.6 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33/11KV, 3x16/20 MVA to 3x20/26 MVA GIS Up-gradation (Stadium) at S&D-Stadium, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1
	GIS cubicles Incoming Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT- 5 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -2 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT-3 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 11 Set (1 set =03 Nos).	Lot	1
3	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT - 3 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2500 A)- 2 No.		
	GIS cubicles Outgoing Feeders (630 A) -18 Nos.		
4	Supply of 33/11 kV, 20/26 MVA ONAN/ONAF Power Transformer with cable end termination facilities, On Load Tap Changer, all internal protection elements in built with complete accessories including Remote Tap changer Control Panel.	Set	3
5	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1

Line Item No	Description of Item	Quantity	
1	2	3	
6	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
7	Battery Charger, constant voltage type (adjustable) with current limiting for boost and float charge, input- 415 volts, output DC 110 - 150 volts including all accessories.	Set	1
8	a)Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories .	Set	1
	b)DC Distribution Panel including all accessories.	Set	1
9	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 225meter. Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Outgoing Feeder. As per field requirement but not less than 1200 meter.	**Lot**	1
10	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 450 meter.	Lot	1
11	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
12	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 1440 meter.	Lot	1
13	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
14	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
15	Supply of all material for Grounding System, Earthing mesh with earthling electrode. (a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.	Lot	1
16	Supply of Station type 11 kV Surge Arrester including all accessories- 21 Set (1 set =03 Nos).	Lot	1

Line Item No	Description of Item	Quantity	
1	2	3	
17	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1
18	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
19	Outdoor and Indoor Lighting System.	Lot	1
20	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
21	Supply of Fire Detection (Smoke Detection & alarm System) **&** Fire Fighting Equipment a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
22	**Civil Works.**	Lot	1
(a)	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Three Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	840
(c)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(d)	Road (approach including internal road & walkway etc).	Lot	1
(e)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(f)	Tree plantation, gardening and beautification etc.	Lot	1
(g)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
23	Installation, Testing, Commissioning of all Equipment.	Lot	1
24	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.1.2.7 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of Up-gradation of GIS Substation at Baraulia at S&D-Fouzdarhat, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1.	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT- 2 Nos.		
	GIS cubicles Outgoing Feeders (1250A) with PT- 17 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (3150A) -1 No.		
	GIS cubicles Power Transformer Feeders (1250A) with PT- 2 Nos.		
	GIS cubicles Station Auxiliary Transformer Feeders (1250A) -1No.		
2.	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 20 Set (1 set =03 Nos).	Lot	1
3.	Supply of 11 kV indoor Gas Insulated Switchgear (GIS) cubicles comprising 2500A Bus including surge arresters other related accessories. All 11 kV Control, Protection and Metering System shall be housed in the same 11 kV GIS panels. All circuit breaker's control with Local/ Remote switch and metering data shall be brought under Substation Automation System (SAS) and is to be interfaced with the existing/future BPDB's SCADA system in Chattogram Zone.	Set	1
	GIS cubicles Incoming Feeders (2500A) with PT - 2 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (3150A)- 1 No.		
	GIS cubicles Outgoing Feeders (630 A) -10 Nos.		
4.	Station Transformer 33/0.4 KV, 250 kVA including all accessories.	Set	1
5.	Supply of LV AC Distribution Panel 3 phase, 415 volts with interlocking including Kwh meter (accuracy class 1.0) and all accessories for station transformer.	Set	1
6.	Battery Charger, constant voltage type (adjustable) with	Set	2

Line Item No	Description of Item	Quantity	
1	2	3	
	current limiting for boost and float charge, input- 415 volts, output DC 110 - 150 volts including all accessories.		
7.	a)Battery, 110volt DC nominal, ≥160Ah minimum with mounting rack including accessories.	Set	1
	b)DC Distribution Panel including all accessories.	Set	1
8.	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Transformer Feeder. As per field requirement but not less than 150 meter.	**Lot**	1
	Supply of 33kV 1C×500 sq.mm XLPE (Cu) Cable as required for Outgoing Feeder. As per field requirement but not less than 4080 meter.		
	Supply of 33kV 3X1C×800 sq.mm XLPE (Cu) Cable as required for Incoming Feeder. As per field requirement but not less than 1440 meter.		
9.	Supply of 11kV Single core XLPE copper cable for Transformer 2x1Cx630 Sq. mm per phase. As per field requirement but not less than 300 meter.	Lot	1
10.	Supply of 33kV 3C×95 sq.mm XLPE (Cu) Cable and 0.415 kV, 4CX120 sq.mm PVC (Cu) Cable for Station Transformer as required.	Lot	1
11.	Supply of 11 kV 3C×185 sq. mm XLPE (Cu) Cable per phase for Outgoing feeder from 11 kV GIS as required. As per field requirement but not less than 800 meter.	Lot	1
12.	Supply of all Cable termination kits in line with BOQ (For all 33 kV, 11 kV and 0.415 kV cable, cable tray along with all requirement (both for indoor and outdoor) including all accessories.	Lot	1
13.	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary and MCCB, connectors to connect different panels/auxiliary transformer etc. 4x4mm2, 4x6mm2, 4x2.5mm2, 8x2.5mm2, 16x 2.5mm2, 24x2.5 mm2, 2x185 mm2 PVC (Cu) Cable for power transformer neutral etc including all accessories.	Lot	1
14.	Supply of all material for Grounding System, Earthing mesh with earthling electrode.	Lot	1
	(a) Supply of grounding copper conductor (As per scope of works and technical Specification). (b) Supply of Grounding copper rod (Earthing electrode) dia 16 mm each 4 Meter length to achieve Earth Resistance as per standard/ requirement.		
15.	Supply of Station type 11 kV Surge Arrester including all accessories- 12 Set (1 set =03 Nos).	Lot	1

Line Item No	Description of Item	Quantity	
1	2	3	
16.	Supply of Substation Automation System (SAS) with Server, Monitor, UPS with 30 Minute battery back-up and Printer etc.	Lot	1
17.	Supply of split type Air conditioner 48,000 BTU/hour capacity (4 Nos).	Lot	1
18.	Outdoor and Indoor Lighting System.	Lot	1
19.	All Steel Supporting Structures (including EM Tower, LA Structure, surge monitor/counter, Supporting Steel Structure and other accessories etc.) of Equipment as applicable.	Lot	1
20.	Supply of Fire Detection (Smoke Detection & alarm System) **&** Fire Fighting Equipment a) CO2-2Sets, b) Foam Type -2 Sets & c) Dry Chemical Type-2 Sets.	Lot	1
21.	**Civil Works.**	Lot	1
	Earth filling, Land escaping, Leveling, Dressing / Preparation of Gravel Pit, Laying of Gravel etc.	Lot	1
(b)	**Three Storied GIS Sub-Station Building :** Including Control Room, Office Room, Store, Evacuation, O/H Tank, Water Supply with new Deep Tube well, Sanitary system, Internal Electrification, Emergency Lighting, False Ceiling, CCTV system with night vision camera and other related items etc. (If required Dismantling, Demolishing).	Sqm	750
(c)	Foundation of Transformer, Equipment, Power & Control Cable Trench, Cable Tray/Rack & others.	Lot	1
(d)	Road (approach including internal road & walkway etc).	Lot	1
(e)	Guard Post (10 Sq-meter) and Boundary wall (with retaining wall where necessary) and Drainage System including gate etc. (As per site requirement).	Lot	1
(f)	Tree plantation, gardening and beautification etc.	Lot	1
(g)	Computer, laser printer, Operation Key Board, Table, chair, Steel Almirah, File Cabinet, Exhaust fans, Ceiling Fans etc.	Lot	1
23	Installation, Testing, Commissioning of all Equipment.	Lot	1
24	Design, Drawing, Training and Inspection of the substation.	Lot	1

6.1.2.8 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Bakolia from 132/33 KV Grid Substation Under S&D-Bakolia, BPDB, Chattogram.

Line Item No	Description of Item	Quantity	
1	2	3	
1	Supply of 33 kV indoor Gas Insulated Switchgear (GIS) unit comprising 2000 Ampere Bus including surge arresters and other related accessories. All 33 kV Control, Protection and Metering System shall be housed in the same 33 kV GIS panels. All the Circuit Breaker's control with Local/Remote switch and metering data shall be brought under Substation Automation System (SAS) and provision for interfacing with the existing/future BPDB's SCADA system in Chattogram Zone .	Set	1
	GIS cubicles Incoming Feeders (2000A) with PT- 1 Nos.		
	GIS cubicles Outgoing Feeders (1600A) with PT-4 Nos.		
	GIS cubicles Bus Coupler Breaker with Riser (Bus Coupler with Riser) (2000 A) -1 No.		
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with supporting structure and required accessories- 4 Set (1 set =03 Nos).	Lot	1
3	Supply of 33kV 3x1C×800 sq.mm XLPE (Cu) Cable as required for Incoming Feeder. As per field requirement but not less than 720 meter.	Lot	1
4	All Cable termination kits (33 kV) for 800 sq. mm XLPE (Cu) Cable both sides along with all accessories and cable support structure for incoming and outgoing feeders.	Lot	1
5	Control Cables including CT and PT cables and LV Power Cables with all accessories between Control Room panels and 33 kV switchyard equipment.	Lot	1
6	All material for grounding connection of individual equipment with substation/ earthing mesh, 185 mm^2 grounding copper conductor, suitable connector and earthling electrode as required to achieve Earth Resistance as per standard.	Lot	1
7	Supply of split type Air conditioner, 48,000 BTU/hour capacity but not limited to.	Lot	1
8	Outdoor and indoor Lighting System with energy saving lamps etc.	Lot	1
9	**Civil Works.**		

Line Item No	Description of Item	Quantity	
1	**2**	**3**	
a)	**GIS and Control room extension etc. (35x2)Sq-meter**	Lot	1
10	Installation of complete Bay with existing system including Inspection, design, drawing, as-built drawing, erection, testing & commissioning.	Lot	1

6.1.2.9 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 33 KV Bay Extension at Shitakundo 132/33 KV Grid Substation under S&D-Barobkundo, BPDB, Chattogram.

Sl No	Description of Item	Unit	Quantity
1	33 kV Vacuum Circuit Breaker, 1600 A, 25 kA for 3 sec. outdoor type along with all supporting structure and all accessories.	Set	2
2	Supply of 33 kV, Single phase Lightning Arrester (ZnO-type) along with all supporting structure and all accessories. 2 Sets(1 set=3 nos)	Lot	1
4	33 kV Isolator 1600A, 25 kA for 3 sec. without earthling blade gang operated vertical mounted vertical break with galvanized steel support structure and necessary connectors and all accessories. 2 Sets(1 set=3 nos)	Lot	1
5	33 kV line isolator 1600A, 25 kA for 3 sec. with earthling blade gang operated vertical mounted vertical break with galvanized steel support structure and necessary connectors and all accessories. 2 Sets(1 set=3 nos)	Set	1
6	33 kV 3× single phase current transformer (3 nos. per circuit) ratio 800-1600/5/5A class 5P20 for protection and 0.2 for measuring along with supporting steel structure and suitable bi-metallic connectors and all accessories as per field requirement.	Set	1
7	Suitable busbar Droppers, Conductors, Connectors, outdoor marshal kiosk, hardware clamps, nuts and bolts, etc. as required for connecting the individual items of equipment of 33 kV switchyard & complete bay extension.	Lot	1
8	PG Clamps including all other Clamps as Required	Lot	1
9	33 kV Disc Insulator set with necessary suitable front and back connecting clamps.	Lot	1
10	33 kV control, metering and protection panel for 33 kV line feeder with 3 O/C, 1 E/F (IDMT, DMT and Ins). 3 Directional O/C + 1 Directional E/F relays including audio visual annunciator and all accessories	Lot	1
11	All Control Cables including CT and PT cables and LV Power Cables with all accessories between Control Room panels and 33kV switchyard equipment.	Lot	1
12	All material for grounding connection of individual equipment with substation mesh, 185 mm^2 grounding copper conductor, suitable connector and earthling electrode as required to achieve Earth Resistance as per standard and all accessories.	Lot	1
16	**Civil Works.**		

a)	Earth filling and compaction as needed, Gravel Pit, Laying of Gravel etc.	Lot	1
b)	Substation switchyard extension, gantry as needed etc.		
c)	Foundation of Equipment, Power & Control Cable Trench etc.		
17	Installation of complete Bay with existing system including Inspection, design, drawing, as-built drawing, erection, testing & commissioning.	Lot	1

6.1.3 Scope of Supply of Plant and Installation Services by the Contractor for 33kV Underground Cable Double Circuit Source Line

General:

The works covered by the Bid/Tender is Design, supply, erection, installation, testing and commissioning and inspection of 33kV Double circuit line of 1x800mm2 XLPE insulated Underground armoured copper Cable including Civil works and other related works on Turnkey Basis under Power Distribution System Development, Chattogram Zone (2nd Phase).

The scope of work and services include design, manufacture, quality assurance, inspection & testing, packing for export, insurance & shipment to site, complete construction & installation, jointing, terminating, bonding, earthing, painting, transportation, setting to work, site testing & commissioning of all the equipment necessary for operation of the 33 kV Source Line and Interconnection between sub-stations along with having the full responsibility for civil works including design and construction of cable trench, H.D Boring for Culvert/Bridge and Railway level cross, Excavation of Soil as required, Backfilling by fine graded sand/ Picket/Brick chips with sand etc.

The detail requirement is listed in the technical specification and Guaranteed Technical particulars (GTP) in the tender document.

The contractor is responsible for ensuring that all and any items of work required for the safe, efficient and satisfactory completion and functioning of the works are included in the Bid price whether they will be described in the specification or not.

Moreover, the contractor shall responsible for Transportation of machineries/equipment to the Project Site including moving the equipment and materials from the designated store as per site requirement and Consignee's advice. All the consumables goods or any equipment/machineries/ materials are required to complete the Plant & Equipment and services shall be responsibilities of the contractor and all the necessary arrangement for Power, Water, accommodations or any such facilities and tools-tackles, necessary instruments required for erection, installation, testing and commissioning will be supplied/arranged by the contractor within the quoted price. The contractor shall handover all the removable materials/goods at the place within layout plan as instructed by the consignee.

33kV, 800mm2 XLPE Armored Underground Cable Supply, Laying & Commissioning:

The bidder shall be deemed to have visited site, inspected, gathered data and verified details of the as-built system in order to design, supply and interface their new equipment. All necessary materials, adjustments, dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price.

The scope of works include survey, design, manufacture, quality assurance, inspection & testing, packing for export, insurance & shipment to site, complete construction & installation etc. as per Employer's Requirement, but not limited to, including all related civil works to complete the work in all respect up to the commercial operation.

Tenderer shall quote a Firm Turnkey Contract Price for the Supply and Related Services as described in Price Schedule according to Section 6 of this Tender document. If the Tenderer deemed necessary any additional machineries/equipment/ materials / Supply and Related Services out of the list of tender Price Schedule for completion of the said Turnkey basis works (Supply and Related Services), contractor shall have to do the additional works (Supply and Related Services) without any additional cost. The costs of these additional works (Supply and Related Services) are deemed to be included within the quoted price.

During execution, the contractor will cooperate with the Substation Contractor and will not claim any damage due to delay in execution of other related works for energisation of substation.

Scope of Work:

- Route Survey will be conducted for the correct assessment of the cable route and finalization of the cable length of the same route. The contractor shall submit the actual route survey to the employer for its due approval.
- Design, Manufacture and Supply of approx. 165 km 33 kV, 1x800 mm^2 XLPE (Cu) Cable with non-magnetic Armour and termite repellent outer covering as per latest relevant IEC Standard.
- Excavation, Installation, Testing and Commissioning of **aforesaid** Cable with supply of necessary Straight Through Joints, with each section of cable length 500 m ± 10%, ensuring protection from all possible external mechanical injury from the side as well as from the top in cable trench and back filling with prominent marker tape as per prevailing standard of BPDB.
- Supply & Installation of 33 KV GIS/AIS Terminations at the both ends of source and destination substation as mentioned hereafter.
- Supply of Plastic Marker Tape with Caution Notice
- Design, Manufacture and Supply of 24 core Fibre Optic Cable inclusive of all accessories.
- The quantity of 33 kV 1x800 mm^2 XLPE (Cu) Cable, route direction & length, no. of circuit, no. of straight through joint & no. of termination kits are mentioned in the following table. It is to be noted that all these quantities are tentative & mentioned as per initial route survey. These figures may change after final route survey.

6.1.3.0 33 kV Source Line and Interconnection are shown below:

Sl. No.	Name of 33 kV Incoming/ Outgoing source Line	Name of 33/11 kV S/S	Proposed Route Length (kM)	No of Circuit
1	**Bakulia Grid S/S to Chawkbazar 33/11 kV S/S**	**Chawlkbazar 33/11 kV S/S (Proposed)**	4.75	2
2	Bakulia Grid to Korbaniganj 33/11 kV S/S	Korbaniganj 33/11 kV Substation (Proposed)	4.5	2
3	33 kV khulshi rising pole grid to Stadium 33/11 kV S/S	Muradpur 33/11 kV Substation (Proposed)	0.25	2
4	Khulsi Grid to Nasirabad New 33/11 kV S/S	New Nasirabad 33/11 kV S/S	3.5	2
Total KM			**13**	

Note:

1. **Road cutting and related work cost will be paid by EPC Contractor.**

6.1.3.1 Design, Supply, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to Chowkbazar 33/11 kV Substation BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and commissioning and so on of the following works are the scope of works:

1) Conducting of Route survey for the correct assessment of the cable route and finalization of the cable length. The contractor shall submit the actual route survey to the employer for its due approval. The proposed route length of the double circuit line is around 4.75 km Bakulia Grid to Chowkbazar 33/11 kV Substation.

2) From Bakalia Grid S/S to Proposed Chak bazar 33/11 KV Sub-station double Ckt. is to be made through (1.0m × 1.05m) trench. The route will be Bakalia S/S towards Shah Amanat Link Road and passing K.B Aman Ali Lalchand Road and Nabab Sirajuddaula, Talipatti Road to proposed S/S at Chak Bazar. In this route electric overhead line exists. But Water, Telephone & Gas line are not visible due to lack of sign.

3) Construction of cable trenches for power cable as per design drawing:

   (a) Throughout the cable route (buried cable)
   (b) Across the roads/railway track
   (c) Within the substation area including cable rack
   (d) Switch yard area to 33kV feeder poles
   (e) Control room building to 33kV feeder poles
   (f) H.D Boring for Road and Railway track crossing
   (g) Soil excavation for cable trench and backfilling with fine graded sand/picket/brick chicps.
   (h) R.C.C cable trench and R.C.C. slab

4) Supply and construction of Power cable trench including cable rack inside the ground floor of the control room building. Proper sealing of the cable entry at Control Room building, to prevent water entering from switch yard/outside to Control Room Building, preventing entry of rats and reptiles, Fire proof etc.

B. ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

1) Supply and installation of two nos. 33kV Line Feeder comprising: 33kV 1Cx800 Sq.mm XLPE power cable, cable indoor GIS terminating kits, straight through jointing kits including all accessories complete in all respect.

2) Supply and installation of Supporting steel structure, cable holder clamp, HDPE pipe for road crossing, MPP pipe for Culvert/Bridge and Railway crossing, cable ties throughout the burial length, cable rack including cable cleats throughout the cable trench within substation area, etc. with necessary accessories as required.

3) The Bidder must visit the site and assess the works before tender submission.

4) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

5) 3 (Three) sets of As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection-2, BPDB

Route line diagram in Annex-1.

6.1.3.2 Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and commissioning and so on of the following works are the scope of works:

1) Conducting of Route survey for the correct assessment of the cable route and finalization of the cable length. The contractor shall submit the actual route survey to the employer for its due approval. The proposed route length of the double circuit line is around 4.5 km from Bakulia Grid to korbaniganj 33/11 kV Substation.

2) Bakalia grid S/S and 33/11KV S/S are situated at adjacent side. The underground cable route for Korbanijonj Poroposed 33/11KV S/S, will start from Bakalia S/S towards Shah Amanat Link Road. Double Ckt cable trench is to be made up to Kalamia Bazar easily.
33 KV double Ckt. trench (1.0m × 1.25 m) is to be made from Kalamia Bazar to Korbaniganj proposed 33/11 KV S/S. This route will run from Kalamia bazar through Mia Khan Road to Korbaniganj. In this route the road is (6m/8m/9m) wide, the road has much turning and exists culverts. No alternate route available except this. In this route there exists overhead electric line.

3) Construction of cable trenches for power cable as per design drawing:

(a) Throughout the cable route (buried cable)
(b) Across the roads/railway track
(c) Within the substation area including cable rack
(d) Switch yard area to 33kV feeder poles
(e) Control room building to 33kV feeder poles
(f) H.D Boring for Road and Railway track crossing
(g) Soil excavation for cable trench and backfilling with fine graded sand/picket/brick chicps.
(h) R.C.C cable trench and R.C.C. slab

4) Supply and construction of Power cable trench including cable rack inside the ground floor of the control room building. Proper sealing of the cable entry at Control Room building, to prevent water entering from switch yard/outside to Control Room Building, preventing entry of rats and reptiles, Fire proof etc.

B. ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

1) Supply and installation of two nos. 33kV Line Feeder comprising: 33kV 1Cx800 Sq.mm XLPE power cable, cable indoor GIS terminating kits, straight through jointing kits including all accessories complete in all respect.

2) Supply and installation of Supporting steel structure, cable holder clamp, HDPE pipe for road crossing, MPP pipe for Culvert/Bridge and Railway crossing, cable ties throughout the burial length, cable rack including cable cleats throughout the cable trench within substation area, etc. with necessary accessories as required.

3) The Bidder must visit the site and assess the works before tender submission.

4) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

5) 3 (Three) sets of As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB

Route line diagram in Annex-1.

6.1.3.3 Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Khulsi Stadium rising Pole to Stadium 33/11 kV Substation BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and commissioning and so on of the following works are the scope of works:

1) Conducting of Route survey for the correct assessment of the cable route and finalization of the cable length. The contractor shall submit the actual route survey to the employer for its due approval. The proposed route length of the double circuit line is around 0.25km from Khulsi Stadium rising Pole to Stadium 33/11 kV Substation.

2) The four 33KV Ckt. will be come out from Stadium rising Pole to Stadium 33/11 kV Substation. It is designed to provide 2 Ckt. 33 KV XLPE U/G cables in a single cable trench.

3) Construction of cable trenches for power cable as per design drawing:

   (a) Throughout the cable route (buried cable)
   (b) Across the roads/railway track
   (c) Within the substation area including cable rack
   (d) Switch yard area to 33kV feeder poles
   (e) Control room building to 33kV feeder poles
   (f) Soil excavation for cable trench and backfilling with fine graded sand/picket/brick chicps.
   (g) R.C.C cable trench and R.C.C. slab

4) Supply and construction of Power cable trench including cable rack inside the ground floor of the control room building. Proper sealing of the cable entry at Control Room building, to prevent water entering from switch yard/outside to Control Room Building, preventing entry of rats and reptiles, Fire proof etc.

B. ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

1) Supply and installation of two nos. 33kV Line Feeder comprising: 33kV 1Cx800 Sq.mm XLPE power cable, cable indoor GIS terminating kits, straight through jointing kits including all accessories complete in all respect.

2) Supply and installation of Supporting steel structure, cable holder clamp, HDPE pipe for road crossing, MPP pipe for Culvert/Bridge and Railway crossing, cable ties throughout the burial length, cable rack including cable cleats throughout the cable trench within substation area, etc. with necessary accessories as required.

3) The Bidder must visit the site and assess the works before tender submission.

4) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

5) 3 (Three) sets of As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of

Design & Inspection -2, BPDB, Dhaka. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB

Route line diagram in Annex-1.

6.1.3.4 Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and commissioning and so on of the following works are the scope of works:

1) Conducting of Route survey for the correct assessment of the cable route and finalization of the cable length. The contractor shall submit the actual route survey to the employer for its due approval. The proposed route length of the double circuit line is from khulsi Grid to Nasirabad New 33/11 kV Substation.

2) From Khulshi Grid S/S a double Ckt. cable can be laid through a trench (1.0m ×1.05 m) in the route Khulshi-Jakir Hossain road (Highway)- side of Foez lake-there is one rail crossing-upto proposed 33/11 KV S/S at Nasirabad Boys School near Mohila College. In this route there exists electrical overhead lines. But the Water, T&T & Gas line are not visible. Even then Cable trench can be made easily.

3) Construction of cable trenches for power cable as per design drawing:

   (a) Throughout the cable route (buried cable)
   (b) Across the roads/railway track
   (c) Within the substation area including cable rack
   (d) Switch yard area to 33kV feeder poles
   (e) Control room building to 33kV feeder poles
   (f) H.D Boring for Road and Railway track crossing
   (g) Soil excavation for cable trench and backfilling with fine graded sand/picket/brick chicps.
   (h) R.C.C cable trench and R.C.C. slab

4) Supply and construction of Power cable trench including cable rack inside the ground floor of the control room building. Proper sealing of the cable entry at Control Room building, to prevent water entering from switch yard/outside to Control Room Building, preventing entry of rats and reptiles, Fire proof etc.

B. ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

1) Supply and installation of two nos. 33kV Line Feeder comprising: 33kV 1Cx800 Sq.mm XLPE power cable, cable indoor GIS terminating kits, straight through jointing kits including all accessories complete in all respect.

2) Supply and installation of Supporting steel structure, cable holder clamp, HDPE pipe for road crossing, MPP pipe for Culvert/Bridge and Railway crossing, cable ties throughout the burial length, cable rack including cable cleats throughout the cable trench within substation area, etc. with necessary accessories as required.

3) The Bidder must visit the site and assess the works before tender submission.

4) Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.

5) 3 (Three) sets of As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB, Dhaka. One electronic copy (soft copy in a CD) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Directorate of Design & Inspection -2, BPDB

Route line diagram in Annex-1.

6.14.0 Bill of Quantities (BOQ)

1. All the items mentioned in the BOQ (as follows) shall be quoted in the respective format of the price schedule, otherwise bid will be rejected.

2. Schedule No: 3 & 5 is applicable for total price of all Substations (Not for individual substation).

5. Tenderer shall quote a Firm Turnkey Contract Price for the Supply and Related Services as described in Price Schedule according to Section 6, Section 7 & Section 8 of this Tender document. If the Tenderer deemed necessary any additional machineries/equipment/ materials / Supply and Related Services out of the list of tender Price Schedule for completion of the said Turnkey basis works(Supply and Related Services), contractor shall have to do the additional works (Supply and Related Services) without any additional cost. The costs of these additional works (Supply and Related Services) are deemed to be included within the quoted price.

6. Individual sub-station Bill of Quantity (BoQ) as follows:

6.1.4.1 Design, Supply, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to Chowkbazar 33/11 kV Substation BPDB, Chattogram.

Sl No.	Description of Work	Unit of Works	Total
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....	KM	31.35
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories	Sets	60
3	33KV Cable Outdoor termination Complete kit.....	Sets	0
4	Ø150 mm MPP Pipe for Road crossing, Culvert/Bridge and Railway level crossing	Meter	3120
5	H.D Drilling for Road crossing, Culvert/Bridge and Railway level cross.	Meter	3120
6	Excavation of Soil as required.	Cum	6282
7	Breaking of pucca surface as required.	Sq. Meter	4188
8	Backfilling by fine graded sand as required.	Cum	4188
9	Backfilling by Picket/Brick chips with sand (1:1)	Cum	1677
10	R. C.C. slab (1:1.5:3) & Cable joint inspection Pit	Cum	441
11	Best quality of Plastic Cable ties	Sets	2327
12	24 Core optical fiber including Silicon tube, Galvanised steel pipe.	KM	10.45
13	Optical fiber cable joint box all accessories.	Lot	0
14	Optical fiber cable termination equipment exclusive of all accessories.	Sets	2
15	Ø40 mm HDPE Pipe	Meter	10450
16	Ø63 mm PVC Pipe.	Meter	1320
17	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.	Sets	2

6.1.4.2 Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Bakulia Grid to korbaniganj 33/11 kV Substation BPDB, Chattogram.

Sl No.	Description of Work	Unit of Works	Total
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....	KM	29.70
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories	Sets	60
3	33KV Cable Outdoor termination Complete kit.....	Sets	0
4	Ø150 mm MPP Pipe for Road crossing, Culvert/Bridge and Railway level crossing	Meter	2760
5	H.D Drilling for Road crossing, Culvert/Bridge and Railway level cross.	Meter	2760
6	Excavation of Soil as required.	Cum	6012
7	Breaking of pucca surface as required.	Sq. Meter	4008
8	Backfilling by fine graded sand as required.	Cum	5210
9	Backfilling by Picket/Brick chips with sand (1:1)	Cum	2084
10	R. C.C. slab (1:1.5:3) & Cable joint inspection Pit	Cum	368
11	Best quality of Plastic Cable ties	Sets	2227
12	24 Core optical fiber including Silicon tube, Galvanised steel pipe.	KM	9.90
13	Optical fiber cable joint box all accessories.	Lot	0
14	Optical fiber cable termination equipment exclusive of all accessories.	Sets	2
15	Ø40 mm HDPE Pipe	Meter	9900
16	Ø63 mm PVC Pipe.	Meter	1200
17	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.	Sets	2

6.1.4.3 Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from Khulsi Stadium rising Pole Grid to Stadium 33/11 kV Substation BPDB, Chattogram..

Sl No.	Description of Work	Unit of Works	Total
1	33 KV 1x 800mm² XLPE Armoured Copper Cable.....	KM	1.65
2	33KV Cable Outdoor termination Complete kits.....	Sets	6
3	33KV Cable Indoor GIS termination Complete kits.....	Sets	6
4	Clamp, Cable holder in S/S Side..as required	Sets	6
5	200 mm HDPE Pipe	Meter	60
6	RCC cable Duct (1:1.5:3)	Cum	138
7	Excavation Soil....	Cum	320
8	15M SPC D Type Pole	Nos	2
9	33kv Tension type Cross arm	Sets	2
10	Double Stud clamp with Nuts and Bolts as required	Nos	8
11	3 Meter M.S. Channel with Nuts and Bolts as required	Sets	2
12	33KV Disc Insulator With Tension Clamp	Sets	6
13	Cable cleat clamp with Nuts & Bolt	Sets	700

6.1.4.4 Design, Supply, Construction, Erection, Installation, Testing and Commissioning of 33 kV Underground Cable from khulsi Grid to Nasirabad New 33/11 kV Substation BPDB, Chattogram.

Sl No.	Description of Work	Unit of Works	Total
1	33 KV 1 x 800mm² XLPE U/G Armoured Copper Cable.....	KM	23.10
2	33 KV Cable Joint kits for 800mm² (Straight through suitable for the 800mm² single core XLPE Cable) Including all accessories	Sets	48
3	33KV Cable Outdoor termination Complete kit.....	Sets	0
4	Ø150 mm MPP Pipe for Road crossing, Culvert/Bridge and Railway level crossing	Meter	1200
5	H.D Drilling for Road crossing, Culvert/Bridge and Railway level cross.	Meter	1200
6	Excavation of Soil as required.	Cum	4572
7	Breaking of pucca surface as required.	Sq. Meter	3048
8	Backfilling by fine graded sand as required.	Cum	3962
9	Backfilling by Picket/Brick chips with sand (1:1)	Cum	1585
10	R. C.C. slab (1:1.5:3) & Cable joint inspection Pit	Cum	324
11	Best quality of Plastic Cable ties	Sets	1694
12	24 Core optical fiber including Silicon tube, Galvanised steel pipe.	KM	7.70
13	Optical fiber cable joint box all accessories.	Lot	0
14	Optical fiber cable termination equipment exclusive of all accessories.	Sets	2
15	Ø40 mm HDPE Pipe	Meter	7700
16	Ø63 mm PVC Pipe.	Meter	240
17	Distributed acoustic sensing (DAS) & distributed temperature sensing (DTS) system for power cable.	Sets	2

6.1.5 Mandatory Spare parts

Name of the Work: Supply of Mandatory Spare parts.

Line Item No	Description of Item	Quantity	
1	**2**	**4**	
1	Supply of HT Bushing for 20/26MVA Power Transformer (1 Set = 3 Nos.)	Sets	2
2	Supply of LT Bushing for 20/26MVA Power Transformer (1 Set = 4 Nos.)	Sets	2
3	Supply of 33kV, Single phase Post type Lightning Arrester (ZnO-type), Class-3	Sets (3 nos.= 1 set)	5
4	Supply of 11kV, Single phase Post type Lightning Arrester (ZnO-type), Class-2	Sets (3 nos.= 1 set)	10
5	Supply of Closing Coil for GIS panel	Sets	10
6	Supply of Tripping Coil for GIS panel	Sets	10
7	Supply of Universal Motor/Spring Charge motor for 11kV GIS panel	Sets	5
8	Supply of Universal Motor/Spring Charge motor for 33kV GIS panel	Sets	5
9	Supply of Differential Relay, 3 O/C + 1 E/F + 3 Directional O/C + 1 Directional E/F for 33kV Control Metering and Relay Panel as per technical specification.	Sets	2
10	Supply of Bay Control and Protection Unit (BCPU), 3 Over Current + 2 Earth fault (1 E/F + 1 Separate Standby Earth Fault) + Directional O/C & E/F relay for 33kV Control Metering and Relay Panel as per technical specification.	Sets	2
11	Supply of Bay Control and Protection Unit (BCPU), 3 Over Current + 2 Earth fault (1 E/F + 1 Separate Standby Earth Fault) + Directional O/C & E/F relay for 11kV Control Metering and Relay Panel as per technical specification.	Sets	5
12	Supply of Heat shrinkable Straight through Jointing kits for 33kV, 800mm^2 Cable including all accessories	Sets	30
13	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 33kV, 800mm^2 Cable	Sets	12

14	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 33kV, 500mm^2 Cable	Sets	6
15	Supply of Heat shrinkable Outdoor termination kit including all accessories for 33kV, 500mm^2 Cable	Sets	6
16	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 11kV, 630mm^2 Cable	Sets	6
17	Supply of Heat shrinkable Outdoor termination kit including all accessories for 11kV, 630mm^2 Cable	Sets	6
18	Supply of Heat shrinkable Indoor GIS termination kit including all accessories for 11kV, 3x185mm^2 Cable	Sets	30
19	Supply of Heat shrinkable Outdoor termination kit including all accessories for 11kV, 3x185mm^2 Cable	Sets	30
20	Supply of Tool box for HV Cable Jointing and Termination	Set	2
21	Supply of Test plug for Power Cable	Sets	2
22	Supply of SFRA Testing Kit with all accessories and Software	Sets	2
23	Supply of Cable fault locator with all accessories (EU/UK/USA/Korea/Japan/Australia make)	Sets	2
24	Supply of Partial Discharge Measurement and Analysis of Transformer & Cable	Sets	2
25	DS/ES Motor Control Unit/ Device/ Card for 33kV	sets	5
26	DS/ES Motor Control Unit/ Device/ Card for 11kV	sets	5

6.2 Specification

The Plant & Equipment shall comply with following Technical Specifications:

Item No	Name of Item or Related Service	Technical Specification and Standards
1	**2**	**3**
	Plant & Equipment	Bidder shall comply the Technical Specifications as per **Section 7** & Guaranteed Technical Particular (GTP) as per **Section-8,** otherwise bid will be rejected.
	Inspection and Tests	*As per Section 7 and Section 8*

6.3 Form of Completion Certificate

Contract No: Date:
To:

[Name of Contractor]

Pursuant to GCC Clause 39 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]*, for the supply and installation of plant and Services for *[name of contract],* we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: _____

2. Date of Completion: _____

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

for and on behalf of the Employer

[***Signature***]

[***Title of the Project Manager***]

6.4 Form of Operational Acceptance Certificate

Contract No: Date:
To:

[Name of Contractor]

Pursuant to GCC Clause 40.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]*, for the supply and installation of plant and Services for *[name of contract],* we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: _____

2. Date of Operational Acceptance: _____

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

for and on behalf of the Employer

[***Signature***]

[***Title of the Project Manager***]

6.5 Form of Change Order Procedure and Forms

Contract No: Date:
To:

[Name of Contractor]

CONTENTS

ANNEXES

Change Order Procedure

1. General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GCC Clause 64 (Change in the Facilities) of the General Conditions.

2. Change Order Log

The Contractor shall keep an up-to-date Change Order Log to show the current status of Requests for Change and Changes authorized or pending, as Annex 8. Entries of the Changes in the Change Order Log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

3. References for Changes

(1) Request for Change as referred to in GCC Clause64 shall be serially numbered CR-X-nnn.

(2) Estimate for Change Proposal as referred to in GCC Clause 64 shall be serially numbered CN-X-nnn.

(3) Acceptance of Estimate as referred to in GCC Clause 64 shall be serially numbered CA-X-nnn.

(4) Change Proposal as referred to in GCC Clause 64 shall be serially numbered CP-X-nnn.

(5) Change Order as referred to in GCC Clause 64 shall be serially numbered CO-X-nnn.

Note: (a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home Office	CR-H-nnn
Site	CR-S-nnn

(b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.

Annex 1. Request for Change Proposal

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within _____ days of the date of this letter _____.

1. Title of Change: _____
2. Change Request No. _____
3. Originator of Change: Employer: _____
   Contractor (by Application for Change Proposal No. _____[16]:
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____

6. Reference drawings and/or technical documents for the request of Change:

   Drawing No./Document No. Description

7. Detailed conditions or special requirements on the requested Change: _____

8. General Terms and Conditions:
   (a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.
   (b) Your estimate shall include your claim for the additional time, if any, for completion of the requested Change.
   (c) If you have any opinion negative to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us of your opinion in your proposal of revised provisions.
   (d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.
   (e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

_____

Signature:	*[insert signature of authorised representative of the Employer]*
Name:	*[insert full name of signatory with National ID Number]*
Title of the Signatory:	*[insert title of the Signatory]*
Name of the Employer:	*[insert name of the Employer]*

Annex 2. Estimate for Change Proposal

(Contractor's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change Proposal in accordance with GCC Sub-Clause64.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Sub-Clause64.2.2, is required before estimating the cost for change work.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Brief Description of Change: _____

4. Scheduled Impact of Change: _____

5. Cost for Preparation of Change Proposal: _____[17]

   (a) Engineering (Amount)

   (i) Engineer _____hrs x _____ rate/hr =
   (ii) Draftsperson _____hrs x _____ rate/hr =
   Sub-total _____hrs

   Total Engineering Cost

   (b) Other Cost

   Total Cost (a) + (b)

[17] Costs shall be in the currencies of the Contract.

Signature:	*[insert signature of authorised representative of the Employer]*
Name:	*[insert full name of signatory with National ID Number]*
Title of the Signatory:	*[insert title of the Signatory]*
Name of the Employer:	*[insert name of the Employer]*

Annex 3. Acceptance of Estimate

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Estimate for Change Proposal No./Rev.: _____

4. Acceptance of Estimate No./Rev.: _____

5. Brief Description of Change: _____

6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparation of Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause64 of the General Conditions.

Signature:	*[insert signature of authorised representative of the Employer]*
Name:	*[insert full name of signatory with National ID Number]*
Title of the Signatory:	*[insert title of the Signatory]*
Name of the Employer:	*[insert name of the Employer]*

Annex 4. Change Proposal

(Contractor's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

In response to your Request for Change Proposal No. _____, we hereby submit our proposal as follows:

1. Title of Change: _____

2. Change Proposal No./Rev.: _____

3. Originator of Change: Employer: *[*_____
   Contractor: _____

4. Brief Description of Change: _____

5. Reasons for Change: _____

6. Facilities and/or Item No. of Equipment related to the requested Change: _____

7. Reference drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description

8. Estimate of increase/decrease to the Contract Price resulting from Change Proposal:[18]

(Amount)

   (a) Direct material

   (b) Major construction equipment

   (c) Direct field labor (Total ____hrs)

   (d) Subcontracts

   (e) Indirect material and labor

[18] Costs shall be in the currencies of the Contract.

(f) Site supervision

(g) Head office technical staff salaries

Process engineer	_____hrs @ _____ rate/hr
Project engineer	_____hrs @ _____ rate/hr
Equipment engineer	_____hrs @ _____ rate/hr
Procurement	_____hrs @ _____ rate/hr
Draftsperson	_____hrs @ _____ rate/hr
Total	_____hrs

(h) Extraordinary costs (computer, travel, etc.)

(i) Fee for general administration, ____ % of Items

(j) Taxes and customs duties

Total lump sum cost of Change Proposal
(Sum of items (a) to (j))

Cost to prepare Estimate for Change Proposal
(Amount payable if Change is not accepted)

9. Additional time for Completion required due to Change Proposal

10. Effect on the Functional Guarantees

11. Effect on the other terms and conditions of the Contract

12. Validity of this Proposal: within *[Number]* days after receipt of this Proposal by the Employer

13. Other terms and conditions of this Change Proposal:

(a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within _____ days from your receipt of this Proposal.

(b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.

(c) Contractor's cost for preparation of this Change Proposal:[2]

[2] Specify where necessary.

Signature:	*[insert signature of authorised representative of the Contractor]*
Name:	*[insert full name of signatory with National ID Number]*
Title of the Signatory:	*[insert title of the Signatory]*
Name of the Contractor:	*[insert name of the Contractor]*

Annex 5. Change Order

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

We approve the Change Order for the work specified in the Change Proposal (No. _____), and agree to adjust the Contract Price, Time for Completion and/or other conditions of the Contract in accordance with GCC Clause64 of the General Conditions.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Change Order No./Rev.: _____

4. Originator of Change: Employer: _____
   Contractor: _____

5. Authorized Price:

   Ref. No.: _____ Date: _____
   Foreign currency portion _____ plus Local currency portion _____

6. Adjustment of Time for Completion

   None Increase _____ days Decrease _____ days

7. Other effects, if any

Authorized by: _____ Date:
(Employer)

Accepted by: _____ Date:
(Contractor)

Annex 6. Pending Agreement Change Order

(Employer's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause64 of the General Conditions.

1. Title of Change: _____

2. Employer's Request for Change Proposal No./Rev.: _____ dated: _____

3. Contractor's Change Proposal No./Rev.: _____ dated: _____

4. Brief Description of Change: _____

5. Facilities and/or Item No. of equipment related to the requested Change: _____

6. Reference Drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description

7. Adjustment of Time for Completion:

8. Other change in the Contract terms:

9. Other terms and conditions:

Signature:	*[insert signature of authorised representative of the Employer]*
Name:	*[insert full name of signatory with National ID Number]*
Title of the Signatory:	*[insert title of the Signatory]*
Name of the Employer:	*[insert name of the Employer]*

Annex 7. Application for Change Proposal

(Contractor's Letterhead)

To: Date:

Attention:

Contract Name:
Contract Number:

We hereby propose that the below-mentioned work be treated as a Change in the Facilities.

1. Title of Change: _____
2. Application for Change Proposal No./Rev.: _____ dated: _____
3. Brief Description of Change: _____
4. Reasons for Change:
5. Order of Magnitude Estimation (in the currencies of the Contract):
6. Scheduled Impact of Change:
7. Effect on Functional Guarantees, if any:
8. Appendix:

Signature:	*[insert signature of authorised representative of the Contractor]*
Name:	*[insert full name of signatory with National ID Number]*
Title of the Signatory:	*[insert title of the Signatory]*
Name of the Contractor:	*[insert name of the Contractor]*

Signature Seal

6.6 Supplementary Information

[The Tenderer shell furnish additional description/information covering all activities, if any]

7.1 TECHNICAL SPECIFICATIONS FOR 33 KV GIS SUBSTATION SWITCHGEAR

7.1.1 SCOPE

This section of the document describes design, configuration, specification, functions, features, capacity, standards, quality etc. which is mandatory requirement to comply but not limited to implement the facility of **[**07 Nos. New 33/11kV GIS Substation, 04 Nos. 33/11kV GIS Substation (Up-gradation), 02 Nos 33 kV GIS Bay Extension**]** complete in all respects. This clause describes the General Technical Requirements for the new 33 KV and general switchyard equipment, and shall be read in conjunction with the Project Requirements, Schedules and Drawings in the specification.

The Contractor shall demonstrate that the GIS has been designed, built and installed in accordance with the relevant international standards and the specification. It shall also operate and perform on a site in accordance with the requirements of the specification and in the environment defined herein. The design shall be proven by the submission at the time of Tender of test certificates covering all specified tests deemed to be pertinent to the plant and to the conditions in which it will operate or, if such test certificates cannot be supplied or are deemed unacceptable by the Engineer, type tests which will be subject to the conditions of this Contract shall be carried out at no extra cost to the Employer. The requirement for switchgear spares, tools and appliances, including test, maintenance and handling equipment shall be as per mentioned in this Tender document. All devices necessary for operation and earthing shall be provided within the Contract Price.

The Contractor shall be responsible for providing equipment as per mentioned in this Tender document, which shall meet in all respects the performance specifications and will have satisfactory durability for the prevailing site conditions. The contractor is responsible for ensuring that all and any item of works (materials and workmanship) required for the efficient, safe and satisfactory completion and functioning of the works in accordance with this specification and all the costs are included in tender price whether they be individually described in the specification or not. It is to be noted that if the Tenderer submit in their offer multiple manufacturing vendor's options for specific item, the Employer/Purchaser shall have right to choose any one among them before contract. Moreover, Manufacturer & Tenderer has to mention only single country of origin (as per ITT 6.3) for the same manufacturer for individual specific item, otherwise his Tender/Bid shall be non-responsive.

7.1.2 REFERENCES

7.1.2.1 British Standards

BS	159	Specifications for HV bus bars and bus bar connections
BS	1977	Specifications for high conductivity copper tubes for electrical
BS	2898	Specifications for wrought aluminium for electrical purposes.
BS	3938	Strip with drawn or rolled edges. Specification for current transformers.
BS	5253	Specifications for AC disconnectors and earthing switches.
BS	6651	Lightning Protection
BS	7354	Code of practice for design of HV open terminal stations.

7.1.2.2 IEC Standards

1.	IEC 62271	HV Switchgear and Controlgear.
2.	IEC 60376	Specification and acceptance of new sulphur hexafluoride
3.	IEC 60480	Guide to checking of sulphur hexafluoride taken from electrical equipment.
4.	IEC 60060	High Voltage test techniques.
5.	IEC 60071	Insulation Co-ordination
6.	IEC 60099-5	Surge arresters Part 5: Selection and application reccommandation
7.	IEC 60129	AC disconnectors (isolators) and earthing switches
8.	IEC 60044-1	Current transformers.
9.	IEC 60044-2	Voltage transformers.
10.	IEC 60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
11.	IEC 61850	Communication network and system in substation
12.	IEC 60529	Degrees of protection provided by Enclosure (IP code)
13.	IEC 60255	Electrical relays
14.	IEC 62271-1	High voltage switchgear and control gear: common specification
15.	IEC 62271-100	High voltage switchgear and control gear: Part 100: Alternating current circuit breakers
16.	IEC 62271-102	High voltage switchgear and control gear: Part 102: Alternating current disconnector and earthing switch

7.1.3 33KV GAS INSULATED SWITCHGEAR (GIS)

7.1.3.1 Switch gear–Design and Performance:

33 KV GIS shall be suitable for indoor location and capable of continuous operation under the climatic conditions existing on site. It shall be designed to comply with this Specification and relevant IEC Standards.

In all cases the ancillary plant facility necessary to complete installation of the equipment shall be included in the Contract. GIS installation and cable termination/connection work shall be executed and supervised by the GIS manufacturer to ensure the required performance based on standard workmanship.

The disposition of plant facility in any substation is to be such that the operation of any item of plant under the specified service conditions shall in no way create a condition that could adversely affect the performance of adjacent circuit breakers or any associated equipment.

The Contractor is to ensure that the complete substation installation will satisfy the requirements of this Specification and the appropriate Standards in respect of insulation, fault levels, mechanical stress etc., and any additional equipment found to be necessary to meet these requirements shall be deemed to have been included in the Contract Price.

The layout and design of plant facility and equipment at GIS sites shall make provision for the

future extensions of same capacity substation shown on the layout drawings and shall provide for ready access for operation, maintenance and extension whilst the remaining sections of equipment are alive. Working clearances provided between isolated equipment and nearest live metal work shall not be less than the British Standard section clearances.

Insulation creepage distances shall not be less than 25mm per KV rated voltage between phases.

The Contractor shall be responsible for ensuring that insulation co-ordination in accordance with recommendation of IEC-71 is achieved. Dynamic and temporary over voltages shall be assumed to be in accordance with normally accepted IEC levels.

The 33 KV GIS with circuit breakers having vacuum interruption facility shall be Indoor, Metal clad, dust & vermin proof, factory assembled, type tested, protected against condensation and aggressive gases, single busbar and single phase encapsulated or three phase encapsulated. All high voltage components/ parts must be fully gas insulated sealed hermetically and safe-to-touch. The Switchgear (primary section) panel shall be filled with insulating gas at sight or in factory and fitted with gas monitoring device with contact. SF_6 may be used as an insulating medium, not for quenching.

All control and monitoring elements should be accessible from the front.

The arrangement of the Circuit-breaker in the panel must be such that in the event of any necessary inspections both the operating mechanism and the arc chambers can be removed and reinstalled from the front or back in a verifiably short time. The bus bars must remain in uninterrupted operation and there must be no reduction in either the insulation level (additional measures such as protective barriers are not permitted) or personal safety. Confirmation must be provided with the quotation.

Each sealed-off gas compartment must have its own pressure relief facility, which in event of arcing fault prevents uncontrolled rupturing of the compartment. The manufacturer must guarantee an adequate pressure reserve between the operating value of the pressure relief and the rupturing pressure of the vessels. The pressure relief facilities must limit the effects of a fault arc to one compartment. Gas escaping under pressure must divert in a direction that is not dangerous for operating personnel; the same applies to fixed parts (rupture diaphragms etc).

Pressure monitoring takes place with contact-making manometer gauges, which function independently for each bus bar section, three-position switch gas compartment or bus bar voltage transformer set respectively or temperature compensated gas sensors for each gas compartment, which shall be equipped with self supervision. The gas pressure gauge shall be installed at the front of the switchgear panel and shall be easily visible.

The gas compartments must be well sealed both mutually and to their surroundings. **The gas loss must not exceed 0.1% per year and compartment.** The filling pressure must be selected so that after thirty years of operation the full test voltages can still be withstand, without any topping up.

The use of plastics must be minimized, in order to likewise minimize the risk of fire in the event of a fault.

The Current transformer must be of the di-electrically non-stressed ring type mounted outside the gas compartment and shall be easily replaceable without gas work.

The Voltage transformer for both busbar and incomer shall be of plug-in-design separate housing filled with SF6 gas to be connected to the bus bar and located outside of the gas enclosure and disconnectable by a three position isolation switch.

Cable termination shall be totally insulated. Cable per phase has to be connected as per scope. Facility with necessary accessories for plug-socket connections are to be as per scope. Sealing/cap for unused cable termination shall also to be provided.

The LV compartment shall be made of high quality sheet steel with powdered coated painting with sufficient space for mounting secondary equipment.

The complete switchgear must be compact in dimension as space is very limited. Also the Switchgear should be suitable for future extension or replacement of panels without affecting the gas enclosures.

Interlocking between the Circuit breaker and three position switch should meet the following conditions:

a) to prevent the disconnector from switching under load, they may only be actuated with the circuit-breaker open
b) the three-position switch must be prevented from switching through from the closed state in to the "ready-to-earth" position.
c) the three-position switch can only be brought into the earthing position if the circuit breaker is open.
d) closing of the circuit-breaker must be blocked for as long as the three position switch has not reached a definite switching position.
e) for earthing of the feeder, reliable "interrogation interlocking" must be provided. Only the three-position switch is switched into the "ready-to-earth" position, feeder can be earthed and short-circuited by closing the circuit-breaker.
f) Earth switch operation shall be blocked when there is voltage in intended Line/ Bus/ Equipment.

Gas compartment must be provided with gas pressure monitoring by pressure gauge with signaling contacts, to signal any increase drop of gas pressure.

The individual panels shall be modular type, to be connected by SF6 insulated bus bar and plug-in outside the SF6 Gas compartment. GIS switchgear shall be suitable for future extension provision at both end or replacement of panels without affecting the gas enclosures.

The switchgear must be extendable at both ends of the bus bars. The incoming and outgoing switchgear panel width shall not be more than 600 mm to ensure the proper use of space.

The Vaccum Circuit Breaker as a making/breaking unit, including operating mechanism, must be maintenance and trip free.

The three-position disconnector (ON-OFF–EARTH) is to reduce the number of functional elements within the encapsulation and together with the circuit breaker, provide make-proof earthing. The Three position switch/ disconnector shall be both motor and manually operated.

In order to reduce the number of mechanical parts within the encapsulation, the operating shafts are to be located outside the encapsulation. The switches are to be operated without a seal via gas-tight welded-in bushings.

The material of the SF6 containers is to consist of non-corroding high-quality steel or aluminium. The live parts are to be insulated against the earthed housing by SF_6 gas.

The Instrument Transformers are to be exchangeable toroidal-core or ring type transformers which are to be used outside the SF6 encapsulation so that they are not exposed to dielectric stress.

The cable terminals of the 3-Phases are to be located horizontally next to one another on one level and are to be easily accessible from the front or rear.

High Voltage Section

The High Voltage section must be maintenance free and immune to environmental influences. The installation must be resistant to accidental arcs.

All switches are to be operated from the front. The circuit breakers must be remotely controllable.

Capacitive dividers in the bushing to the bushing to the cable terminal compartment are to allow safe testing for dead state at the panel front. The degree of protection of the switchgear must not be reduced here.

Gas Compartment Technology

The gas compartment must be tightly sealed. The filling pressure is to be such that at least 30 years service is guaranteed without the necessity of refilling. The design of the HV compartment shall be such that no disruptive discharge will occur between live parts and between live parts and earth even at atmospheric pressure at maximum system voltage.

The pressure of the SF_6 gas is to be monitored inside the gas compartment by means of pressure-gauge boxes or temperature compensated sensor with self supervision. In this way, complete temperature compensation can be achieved. Any pressure drop beyond the safe level as specified by the manufacturer shall be indicated in the form of sound and light alarm. Each Bus-section shall have individual pressure monitoring arrangement. SF6 insulated Bus Bars are to be installed in separate compartment.

The sealed gas compartment must have its own pressure relief device which prevents uncontrolled bursting of the gas compartment when an accidental arc occurs. The manufacturer

must guarantee a sufficient pressure reserve between the operating pressure of the pressure relief devices and the bursting pressure of the container.

Locking Devices
Three-position disconnectors (ON-OFF-EARTH) must be mechanically and electrically Locked and against the circuit breaker.

7.1.3.2 Current Ratings

Every current-carrying part of the switchgear including current transformer, busbars, connections, contacts and joints shall be capable of carrying its specified rated current at rated frequency continuously, and in no part shall its temperature rise exceed that specified in relevant standards.

7.1.3.3 Corona

Equipment shall be designed so as to minimize corona or other electrical discharge and radio interference. Tests for corona and radio interference shall be carried out at Manufacturer's Factory Premisis.

7.1.3.4 Local, Remote and Supervisory Control

Circuit breakers and motorized disconnectors & **earth switches** with manual provision shall be electrically controlled locally, remotely and by supervisory control.

Position indication of these devices shall be provided via auxiliary switches on their operating mechanisms and the Contractor shall include the supply and fitting of the necessary auxiliary switches.

For supervisory control, the interface between the automation devices and the control equipment being provided under this Contract shall be as specified in Section– 7.2 (Substation Automation system)

7.1.3.5 CIRCUIT BREAKERS

7.1.3.5.1 Type

33 KV Gas Insulated circuit breakers having vacuum interruption facility shall have spring operating mechanism.

7.1.3.5.2 Operating Duty and Performance

i) **General**

The requirements of IEC-62271-100 in respect of type tests, service operation and the making and breaking of fault currents shall apply to all types of circuit breakers. Designs shall be suitable for interrupting 3-Phase ungrounded faults.

ii) **Test Certificates**

Circuit breakers shall be covered by test certificates issued by a recognized testing laboratory certifying the operation of the circuit-breaker at duties corresponding to the rated breaking capacities of the circuit-breakers. The test duty shall not be less onerous than the requirements of IEC 62271 or equivalent. Test certificates shall be submitted with the Bid. Test certificates should conform to current standards for type test approval tests.

iii) **Rate-of-Rise of Restriking Voltage**

Attention is drawn to the requirements of the minimum inherent rates of rise of restriking voltage of test plant arrangements. Where not specifically stated in the test certificates submitted with the Bid, the Bider shall certify that the TRV to which the circuit-breaker was subjected during the short circuit tests was the most severe condition that could be imposed by the available test plant for a first phase-to-clear factor of 1.5.

Any device incorporated in a circuit breaker to limit or control the rate of rise of restriking voltage across the circuit breaker contacts shall likewise be to the Engineer's approval and full descriptions of any such device shall be given.

iii) Interrupting Duties

In addition to the requirements of IEC 62271 for interrupting terminal faults, circuit-breakers shall be capable of coping with the interrupting duties produced by the switching of low inductive currents associated with reactors or transformer magnetizing currents, or by the switching of capacitor currents associated with overhead line-charging, cable-charging or capacitor banks as may be applicable.

Circuit breakers shall be capable of interrupting currents associated with short-line faults and the out-of-phase switching conditions that may occur in service.

Bids should include a statement of the accumulative breaking capacity which the circuit-breakers are capable of before maintenance is required.

v) Insulation Coordination

The insulation strength across the open circuit breaker shall be at least 15 per cent greater than the line to ground insulation strength for all impulse, switching surge and power frequency voltage conditions.

7.1.3.5.3 General Arrangement

For indoor sub-station circuit breaker shall be suitable for mounting directly on the cubicle. Evidence shall be provided that enclosures subject to pressures in excess of normal atmospheric pressure during service operation have withstood approved pressure tests without leakage, permanent distortion or any temporary distortion such as might cause maloperation of the circuit breaker.

7.1.3.5.4 Operating Mechanisms

Circuit-breaker mechanisms shall be "trip free" as defined in IEC 62271 and BS 5311:1976. It is

recognized that it may be necessary for contacts to close momentarily prior to opening to ensure satisfactory current interruptions.

Each part of the operating mechanisms 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 designs shall be such as to reduce mechanical shock to a minimum and shall prevent inadvertent operation due to fault current stresses, vibration or other causes.

An approved mechanically operator shall be provided on each circuit-breaker operating mechanism to show whether the circuit breaker is open or closed. Each phase shall incorporate a mechanical indicator or other approved means of position indication where operating mechanism designs do not utilize mechanical coupling between phases. Where circuit breakers comprise three independent units it shall be possible to make independent adjustments to each unit. For 3-Phase operation the three units shall make and break the circuits simultaneously. In the event of any phase failing to complete a closing operation, provision shall be made for automatic tripping of all three phases of the circuit breaker.

Power closing mechanisms shall be recharged automatically for further operations as soon as the circuit-breaker has completed the closing operation and the design of the closing mechanisms shall be such that the cannot be operated inadvertently due to external shock forces resulting from short circuits, circuit-breaker operation or any other cause.

Circuit-breaker operating mechanisms capable of storing energy for at least two complete closing and tripping operations, local to the equipment and without recharging, are preferred. Mechanisms incapable of storing energy for at least two complete operations shall utilize the substation DC supply for recharging the mechanism.

Circuit breaker shall have two tripping coils and one closing coil with in-built free-wheeling diode installed. Circuit breaker operating mechanism shall be spring charged, 230V AC/universal motor driven with following features: electrical remote controlled operating mechanism, trip & restrike free, automatically charged after each closing operation, O-C-O operation without recharging, mechanical/electrical interlocking, anti-pumping relay installed, provision for manual closing spring charging, provision for manual mechanical open/close operation, operation counter, spring charged mechanical & electrical indication etc and all other possible electrical & mechanical interlock installed as per IEC.

Circuit breaker's emergency mechanical OFF push button shall be free from any mechanical & electrical interlocks except permanent feeder earthed & locked scheme.

7.1.3.6 OPERATING CUBICLES

Circuit-breaker operating mechanisms, auxiliary switches and associated relays, control switches, control cable terminations and other ancillary equipment shall be accommodated in aluzinc/anodized coated sheet aluminum vermin-proof and weatherproof cubicles. Where appropriate the cubicles may be free standing. Cubicles are to be painted with RAL 7044 & RAL 7032 colour.

Cubicles shall be of rigid construction, preferably folded but alternatively formed on a framework of standard rolled steel sections and shall include any supporting steelwork

necessary for mounting on the circuit breaker or on concrete foundations. 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 made for locking. Doors and panels shall be rigid and fitted with weatherproof sealing material suitable for the climatic conditions specified.

Cubicles shall be well ventilated through vermin-proof louvres comprising a brass gauge 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. In addition, thermostat controlled anti- condensation heater of an approved type shall be provided and controlled by a single pole switch mounted within the cubicle. In addition, thermostat controlled anti-condensation heater of an approved type shall be provided and controlled by a single pole switch mounted within the cubicle.

Access doors or panels shall be glazed where necessary to enable instruments to be viewed without opening the cubicles. The 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 to associated apparatus.
Circuit breaker control position selector and circuit-breaker operating control switches as specified in the Specification shall be installed in the cubicle. Circuit-breaker control from this position will be used under maintenance and emergency conditions only.

Where practicable an approved schematic diagram of the part of the control system local to the circuit-breaker, identifying the various components within the cubicle and on the circuit-breaker and referring to the appropriate drawings and maintenance 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 site conditions.

7.1.3.7 VOLTAGE TRANSFORMERS

Voltage transformers shall comply with IEC 61869-1 and IEC 61869-3 and the requirements of this specification.

Separate sets of fuses or MCBs shall be provided at the VT for:

a) Each protection scheme
b) Measuring Instruments, recorder etc.

The circuits for each main protection scheme shall be segregated in separate multicore cables from the VT to the protection panels. An (VT failure) alarm shall be provided for each set of fuses and MCB s.

The 33 KV voltage transformers shall be of the following specifications and ratings:
For All the 33kV Incomer & Outgoing Panel (1 set-Line VT): 33 KV /√3: 110V /√3, 110V/√3 for each phase with accuracy class & Burden **0.2, 20VA** for measuring core and **3P, 20VA** for p**rotection core**

For All the 33kV (Each) Bus Section (1 set-Bus VT) (Can be installed in any Feeder panel): 33 KV /√3: 110V /√3, 110V/√3 for each phase with accuracy class & Burden **0.2, 20VA** for measuring core and **3P, 20VA** for protection core

The insulation value of the PT shall be rated maximum system voltage 36 KV and nominal 33KV, BIL-170 KV and Power Frequency withstand voltage for 1 min.70 KV. The burden of the PT shall be 20VA. Secondary voltage (measuring & protection core) of respective bus VT shall be

available in all the adjacent 33kV panels related to this bus. 2 nos. voltmeter with voltage selector switch (6 position) shall be available in the 33kV bus coupler panel for indicating two adjacent bus voltage.

The inductive type Cast-resin insulated Voltage transformer shall be mounted outside the primary enclosure. The VTs can be plugged into the bus bar. The Voltage transformer on bus bar must be designed so that repeat tests can be carried out for 80% Power frequency withstand voltage on the bus bar without removal of the transformer. However, the voltage transformer on bus bar must be capable of withstanding over 100% power frequency withstand voltage under normal operating conditions.

7.1.3.8 CURRENT TRANSFORMERS

Current transformers shall comply with IEC 61869-1, IEC 61869-2 and the requirements of this Specification. Primary winding conductors shall be not less than 100 sq. mm section and shall have a three second short time current rating not less than that of the associated switchgear. Secondary windings of each current transformer shall be earthed at one point only. Magnetization and core loss curves and secondary resistance shall be provided for each type and rating of current transformer. Where the Contractor wishes to provide current transformer ratios differing from those specified, he shall first obtain approval in writing from the Engineer for each specific instance.

Current transformers for balanced protective schemes, including neutral current transformers where appropriate, shall have identical turn's ratio and shall have magnetization characteristics for each specific instance.

Except where stated in the Schedule of Requirements, all current transformers shall have a maximum continuous primary current rating not less than the primary current rating of the bay in which they are installed.

Current transformers shall be capable of withstanding, without damage, the peak and rated specific short-time currents of their associated equipment. They shall also withstand continuously a current equal to 1.2 times the CT ratio, except for transformer circuits when 1.5 times shall apply.

Current transformers provided for protective gear purposes shall have over current and saturation factors not less than those corresponding to the design short circuit level of the system. The output of each current transformer shall be not less than 20 VA with an accuracy limit factor (ALF) of 20 and it shall be ensured that the capacity of the current transformers provided is adequate for operation of the associated protective devices and instruments. Where double ratio secondary windings are specified, a label shall be provided at the secondary terminals of the current transformer indicating clearly the connection required for either ratio. These connections and ratio in use shall be shown on appropriate schematic and connection diagrams.

The accuracy class of all protection CTs shall be 5P or better and that of metering CTs shall be 0.2S or better and factor of security shall be less than 5. The burden of 33KV CT for measurement shall be 20VA and for protection 20 VA (At maximum CT ratio).

Current transformers for all unit type protection shall be of the low reactance type and their performance shall be stated in terms of the Class X parameters of IEC standard (low reactance

current transformers are preferred for all forms of protection). Current transformers may be shown to be low reactance by virtue of their construction as per IEC Standard.

If all the constructional requirements are not met, then type tests will be required to prove that the current transformers are low reactance; the primary test current shall not be less than the through fault(stability) current of the protection.

The CT cores for each Main protection scheme shall be segregated in separate multi-core control cables from the current transformer through to protection panels.

Where double ratios are specified with multiple windings, it shall be possible to select either ratio for each winding without alteration to the number of primary turns.

Neutral current transformers shall be of the outdoor totally enclosed, porcelain bushing type complete with suitable mounting steelwork/cast resin insulation as specified and complete with terminal box for secondary connections.

The Contractor shall provide details of their method of calculating the outputs of the current transformers for each type of protection specified and shall submit calculations for all the current transformers to the Employer before starting manufacture.

Current transformer shall be capable of withstanding without damage at full load, peak and rated short time current.

Current transformers shall be located on the non busbar side of the circuit breaker except where current transformers are provided on both sides of the circuit breaker.

The 33 KV feeder and transformer feeder panel CTs shall have two cores for protection and metering. The capacity, ratio and accuracy class of the CT will be of the following specification and rating:

For 33 KV Line Feeders Incoming:

600-1200/5–5A	1st core 20 VA, acc. 0.2S & FS < 5 for metering 2nd core 20 VA, acc. 5P20 for protection.
1200-2400/5–5A	1st core 20 VA, acc. 0.2S & FS < 5 for metering 2nd core 20 VA, acc. 5P20 for protection.

For 33 KV Line Feeders Outgoing :

400-800/5–5A 1st core 20 VA, acc. 0.2S & FS < 5 for metering
2nd core 20 VA, acc. 5P20 for protection.

For 33 KV BUS Coupler :

800-1600/5–5A 1st core 20 VA, acc. 0.2S & FS < 5 for metering
2nd core 20 VA, acc. 5P20 for protection.
1600-3200/5–5A 1st core 20 VA, acc. 0.2S & FS < 5 for metering
2nd core 20 VA, acc. 5P20 for protection.

For 33/11 kV, 16/20 MVA and 20/26 MVA Power Transformer feeders:

400-800/5-5-5A, 1st core 20 VA, acc. 0.2S & FS: 5 for metering
2nd & 3rd core 20 VA, acc. 5P20 for protection.

For 33/.415kV Auxiliary Transformer Feeders

CT Ratio = 400-800/5-5 A 1st core: acc.= 0.2S, FS <5, 20 VA for metering
2nd core: acc.=5P20, 20 VA for protection

The insulation value of the CT shall be rated maximum system voltage 36 KV and nominal 33KV, BIL-170 KV and power frequency withstand voltage for 1 min. 70 KV.

7.1.3.9 INTERLOCKING FACILITIES

Disconnectors, earthing switches, circuit breakers, etc., shall be provided with an interlocking system, which ensures safe operation of the equipment under all service conditions.

The items of plant supplied under this Contract shall be complete with all interlocking facilities needed for the final arrangement, avoiding the need for future modifications.

Where mechanical key interlocks are employed, they shall be effective at the point where hand power is applied so that stresses cannot be transferred to parts remote from that point.

Tripping of the circuit breaker shall not occur if any attempt is made to remove a trapped key from the mechanism. Emergency tripping devices shall be kept separate and distinct from any key interlocking system and shall be clearly labeled, suitably protected from inadvertent operation but readily accessible.

Circuit breakers shall be interlocked so that, except under maintenance conditions, it is not possible to close a circuit breaker unless the selected bus bar and circuit disconnectors are closed.

Except as stated below, disconnectors shall be so interlocked that they cannot be operated unless the associated circuit breaker is open.

All electrical interlocks shall so function as to interrupt the operating supply, and an approved system of interlocks shall be provided which shall cover the emergency hand operation of apparatus which is normally power operated. Failure of supply (or its restoration after an outage) or of connections to any electrical interlock shall not produce or permit faulty operation. Electrical bolt interlocks shall be energized only when the operating mechanism is being operated. Visible indication shall be provided to show whether the operating mechanism is locked or free. Approved means, normally padlocked, shall be provided whereby the bolt can be operated in the emergency of a failure of interlock supplies.

7.1.3.10 AUXILIARY SWITCHES AND CONTACTORS

Circuit-breakers, disconnectors and earthing devices and circuit selector disconnectors shall be provided with suitably rated auxiliary switches and contactors, where permitted, to relay circuit information for the purpose of control, protection, indication and metering at the substation site as required by the relevant section of the Specification. In addition they shall be provided with auxiliary contacts for position indication to the central system control room via the remote supervisory system. Disconnector auxiliary switches are not to be used for current transformer switching circuits.

Auxiliary contactors shall be provided only where the circuit requirement cannot be met by the auxiliary switch arrangements and multiple contractors and relays will not be accepted in lieu of the auxiliary switches except as specifically approved by the Engineer. Auxiliary switches and contractors shall comply with the requirements of this Specification and in particular shall be capable of operation within the same voltage limits as specified for the associated circuit-breaker close and trip coils.

The connections of all auxiliary switches, including spares, and contractors as well as the associated coil connections and interconnections between auxiliary switches, shall be wired to a terminal board located in the operating cubicle or other approved position.

Auxiliary switches and contractors shall be mounted in an approved accessible position clear of the main operating mechanism but with a minimum of additional mechanical linkages and housed in a substantial weatherproof enclosure. Where adjustable linkages are provided to facilitate the timing of the auxiliary switches with respect to the main equipment, approved locking devices shall be fitted.

Auxiliary switch contacts shall be positively operated, make with a wiping action and, where necessary, discharge resistors shall be provided to prevent arcing when breaking inductive circuits.

Except for the contacts employed for control and interlocking, the requirements for auxiliary switches in respect of timing shall be as follows:

For Circuit Breakers

Normally open contacts, with the exception of two sets of this type, shall close in about 10 milliseconds after the making of the main circuit-breaker contacts and shall open in about 10 milliseconds before the separation of the main circuit-breaker contacts whilst the two remaining sets shall close in about 5 milliseconds before the making of the main circuit breaker contacts and open simultaneously with the main circuit contacts.

Normally closed contacts shall close 10 milliseconds after the opening of the main circuit-breaker contacts and open at least 10 milliseconds before the making of the main circuit-breaker contacts.

For Bus Bar Disconnectors

The operating sequence of any disconnector auxiliary switches used in D.C. circuits for high

impedance bus bar zone protection shall be such that the auxiliary switches operate:-

a) Before reaching the pre-arcing distance on closing the disconnector.

b) After the pre-arcing distance has been exceeded on the opening of the disconnector.

For Earthing Switches

As for Bus bar disconnector auxiliary switches, Auxiliary switches shall be adjustable from normally-open to normally-closed or vice-versa.

Any deviation from the above should be stated in the GTP of Deviations from Specification.

7.1.3.11 33 KV CONTROL, SIGNALING METERING AND RELAY PANEL FOR POWER TRANSFORMER, EACH COMPRISING:

The protection, control & metering panels for 33KV system shall be simplex type so as to accommodate all the control equipment, relays and meters etc. as necessary for completeness of the protection/control scheme without overcrowding and cramping.

a) The panels shall be vermin and dust proof free standing type completely metal enclosed by sheet steel (2.0 mm thick) with necessary reinforcement color gray with appropriate spray painting. The panels shall be neatly and completely wired before shipment. The work relating to protection, control and Metering for 33/11KV Sub-stations shall comprise of development of elementary diagram, design, manufacture, test and supply of pre-wired control panels to be installed in the sub-station control room. The protection, control and panels are to be pre-wired with relays and meters in position. The elementary primary diagram shall be produced giving a clear representation of each protection, control and metering function. The standard design, drawing, manufacturing, testing & performance shall be in accordance to the IEC-60298 standards.

b) The complete panel shall incorporate all necessary instruments, meters, relays, auxiliary relays, control switches, indicating lamps, mimic, annunciators, audible alarms, horizontal and vertical wiring trough, wiring supports, interior lighting system, terminal blocks fuses and links etc.

7.1.3.11.2 Panel Description

7.1.3.11 2A. 33 KV CONTROL, SIGNALING METERING AND RELAY PANEL FOR POWER TRANSFORMER, EACH COMPRISING :

1.	Indicating analogue Ampere meter flush mounting with dual scales options, 0-400/800A for Transformer connection to current transformer ratio 400-800/5-5-5A	3 (three) nos.
2.	Indicating analogue voltmeter with seven position selector switch flush mounting with scales 0-40 KV for connection to potential transformer ratio (33/√3)/(0.11/√3)/(0.11/√3) KV, (50 Hz).	1 (one) set
3.	a) 3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWh meter of class of accuracy 0.2S with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with demand, KVAR, Power factor etc.	1 (one) no.
4.	Numerical programmable type Three Phase combined Over Current and Earth fault Protection Relay of 5 Amps, 50 Hz, 110V dc, 3 second operating time ratings having 3 (Three) over current units and one earth fault with current setting range of the O/C & E/F relay shall be from **$0.1*I_n$ to $40*I_n$** (where I_n is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays (3 O/C element + 1 E/F element) shall have both IDMT & DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability. with all other necessary protection & monitoring functions. The relays are housed in a horizontal, flush mounting draw-out case (tropicalized) with self-reset trip relay (relaying 02 nos. NO contacts as spares) (Not to be included in Differential Relay). The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation. Necessary Binary I/O module along with the relay (alternately separate BCU will also be accepted) shall be provided for SAS/SCADA operation.	1 (one) set
5.	Numerical programmable type Differential relay with REF inbuilt feature for 33/11KV Power Transformer. Scheme of REF protection (High/Low impedance) shall be mentioned clearly. The relay(s) are housed in a horizontal, flush mounting draw-out case (tropicalized) with hand & electrical-reset trip relay (having 02 nos. NO contacts as spares). Differential relay shall have user defined 3 nos. curves for differential and REF protection with second and fifth harmonic blocking features. The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation	1 (one) set
6.	Separate Auxiliary Flag Relays for Device/Self Protection of Power Transformer to be provided. The following Auxiliary Flag Relays shall be available - OTA, OTT, WTA, WTT, **MAIN BA,MAIN BT, OLTC Surge Alarm, OLTC Surge Trip**, PRD for main tank & OLTC, **Oil level low/high for main tank & OLTC** etc. All the mentioned Alarm signals shall be incorporated in SAS.	1 (one) set
7.	All necessary switches (Local and remote selector switch, TNC switch, etc.), CT terminal blocks with inbuilt isolating, shorting & jacking facility for test purpose, PT terminal blocks with inbuilt isolating & jacking facility for test purpose, signaling set lamps, trip circuit supervision relay for each trip circuit coil, PT supervision relay, auxiliary relay, MCB, fuse, terminal blocks and provision for lighting etc. Mimic diagram shall contain Indicator for Isolator/Breaker/Earth switch position. The Annunciator shall have 30 windows or more and have built in buzzer and AC/DC fail relay.	1 (one) set

8.	70 W, 230 V AC, Single Phase heater with thermostat and a visible light indicator which indicate the ''ON''- ''OFF'' position of the heater	1 (one) set
9.	Remote Tap Changer Control facility shall be equipped with Automatic Voltage Regulating (AVR) to facilitate desired voltage regulation. AVR Relay shall have IEC-61850 communication protocol for SAS. It shall also be equipped with Tap position. WTI, OTI, Auto/Manual and Manual Raise and lower switch and Master/Follower control switch to facilitate parallel operation of transformers and appropriate data communication port have to be provided. Also it shall have local/remote selector switch, fan start & stop controlling push button/electrical switch with manual/auto operation mode selection. Indication LED for fan running (Red), fan stop (Green), OLTC in progress (Yellow) etc. shall be provided. Annunciation for OLTC out of step, OLTC faulty/motor tripped, OLTC max./min. position etc. along with other transformer's self-protection alarm & trip signals shall be provided. Annunciator shall have 30 or more window for facilitate all the alarm & trip signals mentioned with built in buzzer/hooter and accept, reset & test push button/electrical switch. OTI & WTI meters measurement/temperature value shall be incorporated into SAS. All the mentioned & required Alarm signals shall be incorporated in SAS. **These facilities can also be provided in separate panel (RTCC).**	1 (one) set
10.	Master trip relay (02 Nos.)	1 (one) set
11.	Capacitive Voltage Divider (CVD) based Live Line Indicator (LLI) system.	1 set

7.1.3.11 2B. 33 KV CONTROL, SIGNALING METERING AND RELAY PANEL FOR INCOMING /OUTGOING LINE FEEDER, BUS COUPLER, STATION AUXILIARY TRANSFORMER EACH COMPRISING :

1.	Indicating analogue Ampere meter flush mounting with dual scales option (0-600A & 0-1200A, 0-1200A & 0-2400A any one may use) for connecting to the current transformer (ratio 600-1200/5-5A, 1200-2400/5-5A) for Incoming feeder respctively.	3 (three) nos.
	Indicating analogue Ampere meter flush mounting with dual scales option (0-400A & 0-800A any one may use) for connecting to the current transformer (ratio 400-800/5-5A) for Outgoing/ Auxiliary transformer feeder.	3 (three) nos.
	Indicating analogue Ampere meter flush mounting with dual scales option (0-900A & 0-1800A, 0-1600A & 0-3200A any one may use) for connecting to the current transformer (ratio 900-1800/5-5A, 1600-3200/5-5A) for Bus coupler respectively.	3 (three) nos.

2.	Indicating analogue voltmeter with seven position selector switch flush mounting with scales 0-40 KV for connection to potential transformer ratio (33/√3)/ (0.11/√3)/(0.11/√3) KV, (50 Hz) . 2 nos. voltmeter with voltage selector switch (7 position) shall be installed in the 33kV bus coupler panel for indicating two adjacent bus voltage and 1 nos. voltmeter with voltage selector switch (7 position) shall be installed in all the 33kV Incomer, Outgoing & Auxiliary Transformer panel.	1 (one) set
3.	3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWh meter of class of accuracy 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with demand, KVAR, Power factor etc. (**N.B.: EXCEPT BUS COUPLER PANEL)**	1 (one) no.
4.	Numerical programmable type Three Phase combined Over Current and Earth fault Protection Relay with directional feature of 5 Amps, 50 Hz, 110V dc, 3 second operating time ratings having 03 (Three) over current units and 01(one) earth fault with current setting range of the O/C & E/F relay shall be from **$0.1*I_n$ to $40*I_n$** (where I_n is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays (3 O/C element + 1 E/F element) shall have both IDMT & DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability with all other necessary protection & monitoring functions. The relays are housed in a horizontal, flush mounting draw-out case (tropicalized) with self-reset trip relay (relaying 02 nos. NO contacts as spares) (Not to be included in Differential Relay). The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation. Necessary Binary I/O module along withthe relay (alternately separate BCU will also be accepted) shall be provided for SAS/SCADA operation. All the numerical relays of 33kV Incomer, Outgoing & Bus Coupler GIS Panel shall have built in synchrocheck (25) function.	1 (one) set
5.	All necessary switches (Local and remote selector switch, TNC switch, etc.), CT terminal blocks with inbuilt isolating, shorting & jacking facility for test purpose, PT terminal blocks with inbuilt isolating & jacking facility for test purpose, signaling set lamps, trip circuit supervision relay for each trip circuit coil, PT supervision relay, auxiliary relay, MCB, fuse, terminal blocks and provision for lighting etc. Mimic diagram shall contain Indicator for Isolator/Breaker/Earth switch position. The Annunciator shall have at least 14 windows and have built in buzzer and AC/DC fail relay.	1 (one) set
6.	70 W, 230 V AC, Single Phase heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater	1 (one) set
7.	Master trip relay (01 Nos.)	1 (one) set
8.	Capacitive Voltage Divider (CVD) based Live Line Indicator (LLI) system.	1 set

7.1.3.11. 2C. FOR 33 KV PANEL FEATURES:

Each PCM panel shall be equipped with the following:

a.) (i) Instruments and Relays described elsewhere. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station. In addition, numerical

relay shall have sufficient contacts and shall be configured for SAS operation. Intermediate auxiliary relay with sufficient spare contacts shall be used for controlling CB or any other switching devices through numerical relay in case of SAS operation.

(ii) The numerical bay control IED's shall be mounted together with all the relevant bay protective relays in cubicles which is to be integrated with SAS.

b.) Electrical push button/TNC switch for Circuit breaker & Three position switch (Disconnector-Earth switch) Open-Close operation in the panel's front side for easy access.

c.) Illuminated Circuit Breaker and Isolator position indicators.

d.) Signaling relays (annunciator, compact type) to yield audiovisual signals on faults and have reset feature.

e.) The inside of the panel will have all auxiliary relays to sense the operation of gas relays, over temperature, over current, differential relay operation failure of auxiliary voltage (DC & AC) etc. and to transmit for tripping and fault signaling.

f.) All inside equipment described and required shall be neatly arranged inside the panel.

g.) Thermostat control heater with status indicating illumination lamp (LED) shall be provided.

h.) The terminal blocks for connecting the incoming multi-core cables shall be placed at the bottom part and necessary glands/ opening shall be provided for the entry of the outside cables.

i.) Sufficient-working spaces shall be provided inside the panel between instruments and wiring for easy approach.

j.) All AC, DC auxiliary power circuits and PT secondary circuits entering the control panel shall be provided with MCCB. Separate MCBs shall be provided for DC supply to Power, Control and Alarm & Indication circuits.

k.) Provision to hang danger/ caution board.

l.) The PCM panel shall be SCADA/SAS compatible and hence all intelligent devices, digital energy meters etc. shall comply IEC61850. All physical connections for control, measurement and status indication shall be made SAS ready.

m.) Sufficient spare terminals (at least 10%) in each terminal block.

n.) Stabilizing resistance and Metrocil of appropriate value by calculation for the high impedence REF scheme (if used) in PCM panel.

o.) There must be two trip coils, both trip coils shall be energized by separate contacts of trip relay for protection tripping. However, for manual tripping, only one trip coil can be engaged only.

p.) All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.

q.) All type of tripping shall be done through Master Trip relay.

r.) Signaling /indicating lamps shall be LED type only.

s.) Auxiliary relays, trip relays with spare contacts, fuses.

t.) All necessary switches etc. Local/remote switches should have at least 4NO+4NC contact.

u.) Provision for lighting etc.

v.) 70W, 230V AC, 1-phase heater with thermostat and control switch and a visible light indicator which indicate the "ON"- "OFF" position of the heater.

w.) Mimic diagram along with semaphore for CB, DS and ES. Mimic diagram shall contain LED based Semaphore Indicator instead of moving Semaphore indicator. The color and size of the mimic shall be as described below:

33 KV	GREEN	½'' X 1/8''
11 KV	BLACK	½" X 1/8"

x.) Ferrule marking and color coding for all type of wiring shall be as follows:

1. **Ferrule marking:** Ferrule marking shall be done by white flexible rubber/ PVC tube with permanent black ink printing on top, fitted with cable, double point addressing (source-destination)
   - i. "A"- for differential protection circuit
   - ii. "C"- for O/C & E/F protection circuit
   - iii. "D"- for metering circuit
   - iv. "E"- for PT circuit
   - v. "L"- for Alarm & Indication circuit
   - vi. "S"- for fault recorder
2. **Color coding:**
   - i. "Black"- for phases of AC supply
   - ii. "White"- for neutral of AC supply
   - iii. "Grey"- for control circuit
   - iv. "Brown & Grey"- for (+) and (-) DC supply respectively
   - v. "Red, Yellow, Blue, Black"- for CT and PT circuit
   - vi. "Yellow with green strip"- for earthing

y.) Detailed schematic diagram of control circuit of PCM inside panel.

z.) Separate relay shall be used for Differential protection. Over current and Earth fault protection shall be combined in one relay.

aa.) Annunciator shall have 14 nos. window for incoming and outgoing panel and 30 nos. windows for transformer panel with builtin buzzer.

bb.) Necessary communication cable and software shall be supplied.

cc) Inter tripping arrangement for 11 kV incomer (from 33 kV transformer feeder tripping) and for 33 kV transformer feeder (from directional tripping of 11 kV incomer or Stand by E/F tripping) shall be provided. Necessary Annunciation at respective panel & signaling for SAS integration shall also be provided.

dd) Transformer incomer PCM panel shall be equipped with AVR relay and tap changing control switch along with necessary indication system (Tap position, temperature etc.). These facilities can also be provided in separate panel.

ee) Alarm signal for CB operating spring charge fail shall be given using settable time delay relay (time needed for charging the spring) and this alarm signal shall be incorporated in the annunciator & SAS.
ff) Transformer Bushing CT's cable connection shall be extended to Transformer Feeder panel.

Besides the provisions of control, signal, protection and metering described, any other provisions to suit with the requirement of associated equipment of the concern feeder shall be provided. All meters and relays shall be flush mounting. There shall be panel-grounding terminal.
The bidder shall quote the particulars of various protective relays, meters, Auxiliary relays signaling relays, discrepancy control and position indicating switches etc. of the control panel, mentioning the names of the manufacturers.

7.1.3.11. 2D. Alarms

The following alarm provision shall be made:

1. **33 KV TRANSFORMER FEEDER (30 window Annunciator)**

Main DC Fail	**AC Fail**	**Main Relay-1 Faulty**	**Main Relay-2 Faulty**	**TCS-1 Unhealthy**	**TCS-2 Unhealthy**
PT Failure	**OTI High Alarm**	**OTI High Trip**	**WTI High Alarm**	**WTI High Trip**	**PRD Trip**
MT Buchholtz Alarm	**MT Buchholtz Trip**	**OLTC Surge Trip**	**O/C Trip**	**E/F Trip**	**87T Trip**
87N/64 Trip	**11 kV Inter trip**	**Main tank oil level high/low**	**Lockout operated**	**Trip relay-2 operated**	**Gas fault**
Spring Charge Fail	**OLTC BZ Alarm**	**OLTC PRD Trip**	**SCADA/ Remote Trip**	**Spare**	**Spare**

2. **33 KV INCOMING/OUTGOING/BUS COUPLER/AUXILIARY TRANSFORMER FEEDER (MINIMUM 14 WINDOW ANNUNCIATOR)**

Main DC Fail	**AC Fail**	**Main Relay Faulty**	**PT Failure**
TCS-1 Unhealthy	**TCS-2 Unhealthy**	**O/C Trip**	**E/F Trip**
67 Trip	**67N Trip**	**Trip relay operated**	**Gas fault**
Spring Charge Fail	**SCADA/ Remote Trip**	**OV/UV Trip(Only for IN/OUT Panel)**	**Spare**

7.1.3.11.2E PROTECTIVE RELAYS

All Protective relays shall be numerical programmable type and shall comply relevant IEC or equivalent international standard. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station.
All the protective relays shall be supplied from any of following manufacturers:-

a) ABB (Switzerland/Sweden/Finland).
b) Siemens (Germany).
c) ALSTOM (UK/France)
d) Schneider Electric (UK/France)
e) NR, China
f) SEL, USA
g) Honeywell, USA

****** 33 kV Incomer, Outgoing & Bus Coupler Feeder panels Relay should have synchronization (25) function.**

Note: Supply of Related software with required license keys & accessories is within the scope of supply.

7.1.3.11.2F ENERGY METERS

KWH meter shall 3-phase 4-wire, Numerical Programmable Multifunction KWH Meter of accuracy class 0.2S with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with maximum demand, KVAR, Power factor etc.

It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850. However, the detail specification of the meter shall be same as that for 33 kV PCM panel meter described in **clause 7.1.4.1.N.**

All the energy meter shall be supplied from any of the following Country: -

a) European Country.
b) North American Country.
c) Japan
d) Australia

The tenderer should submit authentic document with the tender against the country and location of the offered Electric Energy Meter Manufacturing plant which will be verified during tender evaluation.

Note: 1. Manufacturer's authorization for Protective Relays & Energy Meters (KWh) shall furnish with the offer. Necessary software & accessories is within the scope of supply.
2. The features in above section 7.1.3.11.2 can be provided in LV Compartment of GIS or in separate PCM Panel

7.1.3.11.3 PANEL CONSTRUCTION DETAILS

a) The Control and Relay Board shall be of Simplex, completely metal closed and the access door shall be provided at the back of each Panel where no instruments or relays shall be mounted. The indicating and signaling devices etc. shall be mounted on the front side and the auxiliaries which shall be inside the Panel.

b) Cubicles shall be drip-proof, and vermin proof, with the minimum IP41 protection degree. Equipment shall be arranged to give reasonable access to all components mounted on the panel front and inside.

c) The individual panel shall be approximately 2300 mm in height with Channel base, 900 mm. in depth and of suitable width limited to 1000mm to accommodate the equipment at a suitable height, suitable gaps to facilitate easy workability as specified hereafter. Individual piece of Channel base of PCM Panel is to be provided to obtain the flexibility of inter-changing the Panel, if any.

d) Each panel shall be fabricated from steel sheet (minimum 2mm thick) with necessary steel member reinforcement to make the structure self supporting. All joints are to be welded and ground to be made smooth.

e) Doors shall be secured by locking integral handles and locking provision shall be made.

f) Mounting brackets required shall be arranged inside the panel for mounting and fixing auxiliary devices and terminal blocks.

g) Instruments meters control switches and protective relays shall be mounted on the front panel only. Panel output mounting studs and support brackets shall be accurately located.

h) Finished panel surface shall be free of waves and other imperfections exterior panel surfaces shall be send blasted, ground smooth, filled, panel and finished with gray enamel. Interior surface shall be sand blasted, primed and finished with glass white enamel.

i) The complete panel shall incorporate all necessary instruments, meters, relays, auxiliary relays, control switches, indicating lamps, mimic, annunciator, audible alarms, horizontal and vertical wiring trough, wiring supports, interior lighting system, terminal blocks , fuses and links etc.

j) The supplier shall furnish internal panel wiring and circuit protection. The supplier shall provide one 70W, 240, AC strip heater in the panel. The heater shall have a separate switch.

k) A lamp shall be fitted inside each cubicle and a utility socket in selected cubicles and so arranged that all wiring is illuminated as evenly as possible without dazzle. The lamps shall be controlled from a door switch. The sockets shall be fused.

l) Design, material selection and workmanship shall be such as to result in neat appearance, inside and outside with no welds, rivets or bolt head apparent front outside, with all exterior surfaces tune and smooth.

m) Cable entries to the panel shall be from the bottom. The bottom plates of the panel shall be fitted with removable gland plates and fixed with cable glands.

n) Engraved name plate shall be provided at the top of the front enclosure with informaiton BPDB, Contact No., Project Name, Manufacturer, Year of manufacture etc.

7.1.3.11.4 Assembly :-

Necessary items of equipment shall be assembled in the factory prior to shipment and routine tests shall be performed by the manufacturer as per the requirements of the latest issue of IEC as specified under each equipment in these specifications to demonstrate to the satisfaction of BPDB that the switchgear panels comply with the requirements of the relevant IEC standards.

7.1.3.11.5 Casting :-

Casting shall be true to pattern, of workmanlike finish and of uniform quality and condition, free from blowholes, porosity, hard spots, shrinkage defects, cracks or other injurious defects, shall be satisfactorily cleaned for their intended purpose.

7.1.3.11.6 Welding:-

Wherever welding is specified or permitted, a welding process, including stress relieve treatment as required if necessary, conforming to an appropriate and widely recognized professional standard shall be used. All welders and welding operators shall be fully qualified by such a standard.

7.1.3.11.7 Panel Wiring

The supplier shall provide internal wiring and connections, in accordance with the requirements of the following paragraph.

a) All wiring shall be carried out with 1100 volts grade single core, multistrand flexible tinned copper wires with PVC insulation which has provided its utility in tropical region against hot and moist climate and vermin.

b) All wiring used within the panel shall conform to the requirements of these specifications and shall be installed and tested at the factory. All wiring shall be neatly and carefully installed in wring gutters of raceway wiring raceway shall be plastic wiring duct with covers. Instrument wiring on the panel shall be numbered sequentially from the sources to the panel instrument and the number of the source equipment shall be used as a prefix for the individual wire numbers, wiring shall be terminated at terminal blocks plainly lettered or marked in accordance with the manufacturer's connection diagrams.

c) Sufficient clearance shall be provided for all the leads. All the leads for external circuit wiring shall be connected to grounded terminal blocks located for convenient connection of external circuits.

d) Splices will not be permitted in panel wiring. Each wire shall be continuous from end to end and shall not have any joint within itself individually.

e) All the terminal block connections shall be made with ring type lugs. Pre-insulated ring type terminals with crimp guide or per-insulated slotted spring spade terminals shall be provided on devices equipped with individual fitted covers.

f) Arrangement of circuits on terminal block shall be such that all the connections for one circuit, plus any spare conductors, shall have terminal blocks adjacent to the split and shall be provided with wiring required to interconnect the split unit.

g) Terminal Ends of all wires shall be provided with numbered Ferrules . At point of inter-connection where a change of number is necessary, duplicate Ferrules shall be provided with the appropriate numbers on the changing end.

h) Wire termination shall be made with solder less crimping type and tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected for any purpose. Termination shall be such that no strand of a conductor shall left loose or overhanging. Conductor termination shall be secured to the holding nuts/screws, terminal blocks etc. with washers between the terminals/holding nuts/screw heads. The terminals shall be so connected that no conductor ferrule code gets masked due to overlay of conductors.

i) Wiring connected to the space heaters in the cubicles shall have porcelain beaded insulation over a safe length from the heater terminals.

j) All spare contacts of relays shall be wired up to terminal blocks

k) The size of the wiring used in the panel shall be conform to the following requirements:-

Table 1

Circuit	**Permissible size of wire**
Metering and Relaying Circuits connected Current Transformer	minimum 4 Sq.mm.
Potential Circuits for metering and Relaying, Control, Visual Audible Alarms and Signaling Circuit	minimum 2.5 Sq.mm

The following colour schemes shall be used for the Wiring:

Table 2

Circuit where used	**Colour of Wire**
Red Phase of Instrument Transformer Circuits	Red
Yellow Phase of Instrument Transformer Circuits	Yellow
Blue Phase of Instrument Transformer Circuits	Blue
Neutral connection, earthed or not earthed in the instrument Transformer Circuit	Black
A.C. Control Wiring Circuits using auxiliary supply	Black
D.C. Control Wiring Circuit using Battery Supply	Grey
Earth Connection	Green

Closing circuit of the PCM panel shall have Interlocking mechanism with DS/ES switch. DC/AC supply of the 33 kV breaker panel shall be supervised through corresponding PCM panel. Single point grounding of the neutral of CT/PT circuits shall be ensured. It is always recommended that the neutral of CT/PT is grounded at the CT/PT junction box end. Ferrule marking and color coding shall be as per clause **"7.1.3.11 2C 33 kV Panel Features"**

7.1.3.11.8 TERMINAL BLOCK

Terminal blocks shall be of clip-on design made out of non-trackable insulating material of 1100 V grade. All terminals shall be stud type, with all current carrying and live parts made of tinned plated brass. The studs shall be of min 4 mm dia brass. The washers, nuts, etc. used for terminal connectors shall also be of tinned plated brass. All blocks shall be shrouded by easily removable shrouds made of transparent die-electric materials.

The terminal connector/blocks shall be disconnecting type terminal connectors for PT and same with automatic shorting of C.T. secondary terminals shall be provided in CT secondary circuit. All other terminal connectors shall be Non-disconnecting type. Terminal should be shock protected in single moulded piece. Terminal block should have screw locking design to prevent loosening of conductor. Provision shall be made on each pillar, for holding 10% extra connection (5% incoming + 5% outgoing).

At least 20% spare terminals for each type shall be provided. All terminals shall be provided with ferrules indelibly marked or numbered and identification shall correspond to the designations on the relevant wiring diagrams. The terminals shall be rated for adequate capacity which shall not be less than 10 Amps for control circuit. For power circuit it shall not be less than 15 Amps.

All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.
CT, PT, Control, Alarm etc. wiring shall be separately grouped or segregated.
All physical connections for control, measurement and status indication shall be made SAS ready hence Terminal Blocks shall be kept reserved if necessary.

7.1.3.11.9 INDICATING LIGHTS

The lamps shall be of LED type and suitable for being operated on S/S D.C. voltage or AC voltage or P.T. secondary supply as and where applicable. All Lamps shall be interchangeable, panel mounting type with rear terminal connection and shall afford easy replacement from the front of the panel. Lamps shall have translucent lamp covers to diffuse lights and coloured Red, green, Amber, clear white or blue as specified. The lamp cover shall be of screwed type, unbreakable and mounded from heat resisting material. The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis. It is recommended to install the CB, DS & ES Open/close indicating LED lamp/semaphore in the mimic bus. If space is not available, these indicating LED lamps/semaphore can be installed in the front panel along with other indicating LED lamps.

The colour scheme of the signal lamps shall be as follows:

Sl. No.	Functions	Quantity	Color of the Lamp
1	Heater ON Indication	1No	Yellow

7.1.3.11.10 POWER SUPPLY DISCONNECT

Each panel mounted devices requiring AC or DC supply, shall have separate disconnecting devices (MCB). The MCBs used in DC control circuit shall have a voltage rating 125 VDC and sufficient current rating as per use. The fuses shall be modular type with Bakelite frame and reinforced retaining clips.

7.1.3.11.11 TERMINAL BLOCKS

Terminal blocks shall provided with white marking strips, circuit designation by the supplier shall be inscribed on the marking strip with black print, terminals in a quantity of not less than 25 percent of the interconnected terminals in excess shall be provided on each terminal block for circuit modifications and for termination of all conductors in multi-conductor cable.

CT terminal blocks shall have isolation, shorting & jacking facility while PT terminal blocks shall have isolation & jacking facility. CT, PT, Control, Alarm, etc. wirings shall be separately grouped or segregated. SCADA Terminal Block for CT/PT/CB Close-Open facility.

Terminal block shall be grouped in each panel for easy accessibility unrestricted by interference from structural members and instruments. Sufficient spaces shall be provided on each side of each terminal block to allow an orderly arrangement of all the lead to be terminated on the block.

7.1.3.11.12 INSTRUMENTS AND DEVICES

Indicating, analogue instruments shall be semi flush panel type with 1% percent accuracy class except for energy meters which shall be of 0.2S. They shall be approximately 100 mm square with black 250 degree scales on a white back ground.

All AC instruments shall be designed for operation on 5 A current transformers secondary and 110V (50 Hz) potential transformer secondary.

7.1.3.11. 13 PANEL LIGHTING

a) The Panel interior shall be illuminated by CFL lamps connected to 230 Volt Single Phase A.C. The illumination of the interior shall be free from shadows and shall be planned to avoid any strain or fatigue to the wireman likely to be caused due to sub-normal or non-uniform illumination. One emergency D.C. light shall be provided for each panel with individual switch with proper identification mark.

b) A toggle switch or door operated switch shall be provided for control of A.C. lighting in each panel.

c) One combined 15 Amps. 3-Pin and 5 Amps. 2-Pin Power Socket outlet together with Plus Pins shall be provided at convenient points in each Panel for A.C. Supply.

7.1.3.11.14 CONTROL AND SELECTOR SWITCHES

All switches shall be located at a convenient operating height and so constructed, mounted and wired to facilitate the maintenance of contacts without the need to disconnect wiring. Switches shall have locks incorporated in the design. Control switches must be lockable in the inactive or

neutral position and selector switches in all positions. Labels shall clearly indicate all positions and function of each switch.

7.1.3.11.15 Control Switches

Control switches shall be of either the handle type and shall be arranged to operate clockwise when closing the circuit devices and anticlockwise when opening. Handle type switches shall be so designed that when released by the operator the handle and mechanism shall return automatically to the centered neutral position and interrupt the supply of current to the operating mechanism of the circuit device. All control switches shall have additional labeling giving the reference identification of the primary device. A lamp test facility shall be provided in association with any discrepancy switch.

7.1.3.11.16 SELECTOR SWITCHES

Selector switches shall have spade type handles. Where key operated switches are specified these shall be operated by inserting and turning the key to the required position. The key shall be removable in the 'off' position only.

7.1.3.11.17 ANNUNCIATOR

1. Suitable electronic Annunciator for the visual and audible alarm on the control panel using bright LEDs shall be provided in each panel to indicate over current and earth fault protection operated. In addition to above, each electronic annunciator of Transformer Control Panel shall have provision to indicate Transformer trouble trip/alarm function operated. Also one window of the Annunciator shall have to be used for Non-Trip A.C. Fail Alarm Indication and one window for Trip Circuit unhealthy indication. Each Electronic Annunciator shall have provision for connection with accept/reset/lamp test/mute Push buttons for proper functions. Electronic annunciator shall have provision for connection with Electronic Buzzer/Electronic Bell for Trip & Non-Trip Audio Alarm of common annunciation scheme. Electronic Annunciation shall have provision for flashing illuminating display with inscription for operation of respective Protection Relay. The Electronic Annunciator should have separate coloured windows for Trip & Non-Trip Annunciation for easy detection.

2. Annunciator fascia units shall have translucent plastic windows for each alarm point.

3. Annunciator facia plate shall be engraved in black lettering with respective alarm inscription as specified. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall be about 5 mm. The inscriptions shall be visible only when the respective facia LED will glow.

4. Annunciator facia units shall be suitable for flush mounting on panels. Replacement of individual facia inscription plate and LED shall be possible from front of the panel.

5. Unless otherwise specified, one alarm buzzer meant for non-trip alarms and one bell meant for trip alarms shall be provided in each control panel (mounted inside).

6. Each annunciator shall be provided with 'Accept', 'Reset' and 'Test' push buttons, in addition to external PB.

7. Special precaution shall be taken by the manufacturer to ensure that spurious alarm conditions do not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighbouring circuits within the panels.

8. In case 'RESET' push button is pressed before abnormality is cleared, the LEDs shall continue to glow steadily and shall go out only when normal condition is restored.

9. Any new annunciation appearing after the operation of 'Accept' for previous annunciation, shall provide a fresh audible alarm with accompanied visual alarm, even if the process of "acknowledging" or "resetting" of previous alarm is going on or is yet to be carried out.

10. The annunciator shall have provision for operating on both 110VDC & 240VAC, single supply at a time, mainly 110VDC operated and should generate alarm for any of the supply fail. All the annunciator shall be window type with Multicolor glowing lamp such as. Red for Trip signal and White for general alarm signals and Also Annunciator shall have built-in mute & acknowledge option accessible via SAS command.

7.1.3.11.18 INDICATING AMMETERS

Each 33kV PCM Cubicle will be provided with 3 Ammeters, analogue type (1 for each phase).

7.1.3.11.19 INDICATING VOLTMETERS

1 (one) voltmeter with selector switch, analogue type with a multi-selector switch (phase to phase, phase to neutral, off **)** shall be installed on every 33kV Incomer, Outgoing, Power Transformer & Bus Coupler panel. 2 nos. voltmeter with voltage selector switch (6 position) shall be installed in the 33kV bus coupler panel for indicating two adjacent bus voltage.

7.1.3.11.20 EARTHING SYSTEM

Earthing of metallic parts or metallic bodies of the equipment on the Panel shall be done with soft drawn single conductor bare Copper Tail connections shall have minimum area of 16 sq, mm. and the main earthing connection 60 sq.mm. These wires shall be connected by suitable terminals and clamps junction. Soldered connections shall not be employed.

All metal parts other than those forming part of any electrical circuit shall be earthed to the earthing system. Any necessary terminals on any part of the equipment required for this purpose shall be provided by the Manufacturer. Earthing conductor cross section shall be in accordance with the manufacturer standards which shall be proved with necessary type test reports. However, for 33kV switchgear minimum 300 mm^2 cross section copper bar shall be employed for earthing. The copper earth bar shall run along the full length of the switchboard and earthing studs shall be provided at not less than two points. The frame of the draw-out circuit breaker earthing truck shall be automatically connected to the switchgears bar through substantial plug type contact when the circuit breaker is in disconnection, service and test position.

7.1.3.12 DISTRIBUTION AND CONTROL OF AUX. POWER CIRCUIT

7.1.3.12.1 D.C. CIRCUIT

There shall be only one **110V D.C**. for the entire Control and Relay Panel fed from a D.C. Distribution Panel. A continuous D.C. Bus shall be provided in the Control and Relay Panel and D.C. supply for control, protection, indication and supervision of circuit breaker and other equipment shall be teed off from D.C. bus through a set of MCB on positive and negative side. D.C. supply to be teed off shall be distributed within the Panel as below:

(a) Control DC scheme both positive and negative side with MCB
(b) Close & Trip Ckt-1 with 1 nos. 10A MCB (rating shall be as required) and Trip Ckt-2 with another MCB of 10A (rating shall be as required)
(c) Indication Circuit through a set of 6 Amp. MCB both at +ve and –ve side
(d) Protective relay circuits through 6A MCB both at +ve and –ve side
(e) Annunciation ckt with 6Amp MCB on both at +ve and –ve side
(f) DC Emergency Lamp with 6Amp MCB both at +ve and –ve side

DC Supply MCBs (Main supply, Control supply, Device supply, Indication supply, Annunciation supply etc.) shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration.

7.1.3.12.2 A.C. CIRCUITS

230 Volts, Single Phase A.C. Aux. Supply to the Control and Relay Panel will be fed from A.C. Distribution Panel through a 16Amp MCB provided there. One 16 Amps rated MCB shall be provided at the Control & Relay Panel for the Incoming A.C. Supply. All the AC Supply MCBs (Main supply, Spring charge motor supply, TPS motor supply, lighting & heating supply etc.) shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration.

7.1.3.12.3 P.T. SECONDARY CIRCUIT

There may be two nos. 33KV bus PT, one in each bus section. Two sets of Fuse and link or 2 nos. 4 pole MCB of suitable rating shall be provided for the Incoming P.T supply's Measuring & Protection circuit. Colored LED indicating lamps shall be provided for supervision of the Fuse. Lamps shall be connected between respective phases and neutral. The arrangement of distribution of P.T. Secondary Circuit shall be as follows:

(a) Measurement & Protection function of all the 33kV Incomer & Outgoing panel shall be done using respective feeder's Line VT and Measurement & Protection of all the 33kV Power Transformer, Auxiliary Transformer & Bus Coupler panel shall be done by using respective adjacent Bus's Bus VT.
(b) Selected P.T. secondary supply to the protective relays of each panel shall be fed through 4 poles - MCB and link in neutral in each panel where necessary with two change over contacts for annunciation.

(c) Selected P.T. secondary supply for metering and indicating instruments of each panel shall be fed through 4 pole MCB in each phase and link in neutral in each panel of 33KV system voltage.

(d) Synchrocheck (25) function of all the 33kV Incomer & Outgoing Feeder shall be done by respective feeder's Line VT & adjacent Bus's BUS VT and Synchrocheck (25) function of all the 33kV Bus Coupler Feeder shall be done by adjacent 2 Bus's Bus VT

7.1.3.13. TRIP RELAYS

Following shall be the main features of a high speed tripping relays:

All tripping relays shall be of the heavy duty type suitable for panel mounting and shall have operating coils which are rated sufficiently to operate in conjunction with series flag relays. If necessary, normally closed contacts in series with the relay operating coil, shall be delayed for a period which will allow series flag relays to operate satisfactorily. All other tripping contacts should be instantaneous i.e. no intentional time delay. The operating time shall not exceed 10 milliseconds at rated voltage. The operating range of the relay shall be from 70% to 120% of rated voltage. Electrical reset facilities shall be available for operation, from remote and supervisory controls. High speed tripping relays shall prevent closing of the associated circuit breakers until reset. Wherever the tripping relay contacts need to break the d.c. current, sufficiently rated magnetic blow out contacts or such approved means shall be used.

Trip Relay shall be of following types:

a. Self-reset type for O/C, E/F protection
b. Hand & Electrical reset type for Differential, REF and Transformer Self-protection
c. Operating Coil Voltage: 110 V DC (No series resistor allowed)
d. Shall have in built freewheeling diode.
e. Trip relay for OC/EF will be self-reset type and for Differential/REF & Transformer Self (mechanical) Protection shall be "Hand and Electrical Reset" type with at least two NO contacts as spare.

7.1.3.14. SUPERVISION RELAYS

7.1.3.14.1 Trip Circuit and Protection Supply Supervision

The trip circuit supervision function shall be a seperate relay and independent of control part of control and protection unit provided in the switchgear. Trip circuit supervision relays shall be provided to monitor each of the trip circuits of all 33kV circuit breakers and each relay shall have sufficient contacts for visual/audible alarm and indication purposes. The trip circuit supervision scheme shall provide continuous supervision of the trip circuits of the circuit breaker in either the open or closed position and independent of local or remote selection at the local operating position. Relay elements shall be delayed on drop-off to prevent false alarms during faults on dc wiring on adjacent circuits, or due to operation of a trip relay contact. Series resistances shall be provided in trip supervision circuits to prevent mal tripping a circuit breaker if a relay element is short circuited. Relay alarm elements shall be equipped with hand resetting flag indicators.

Trip circuit supervision relay (TCS) shall supervise not only the trip coil but the whole trip circuit during both breaker open and close position (pre-close & post-close). Each trip circuit shall be supervised by separate Trip Circuit Supervision (TCS) relay.

All the TCS relay shall have at least 3NO+3NC contact for Indication, Annunciation & SAS Integration. 2 NO contact shall be used for CB closing circuit interlock & closing readiness indication (if used) and 2 NC contact shall be used for TCS faulty Annunciation & SAS integration.

7.1.3.14.2 PT Supply Supervision

Each PT supply secondary circuit shall be supervised by individual 110V A.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main PT supply entry point at terminal block with inscription "Measuring/Protection P.T. Supply Supervision relay" with at least 2NO+2NC contact for Signaling, Annunciation & SAS integration. The relay shall detect failure of PT supply. As per requirement mentioned in the section 7.1.3.12.3, 1 NO contact of the PT supply supervision relay & PT supply MCBs shall be used for PT supply healthy indication (if used) and 2 NC contact shall be used for PT supply faulty Annunciation & SAS integration.

7.1.3.14.3 D.C. Supply Supervision

There shall be one 110V D.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main DC supply entry point at terminal block with inscription "Main D.C. Supply Supervision relay" and shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration.
As per requirement mentioned in the section 7.1.3.12.1; 1 NO contact of the Main DC supply supervision relay & DC supply MCBs shall be used for DC supply healthy indication (if used) and 2 NC contact shall be used for DC supply faulty Annunciation & SAS integration, these supervision relays are to be independent of alarms from the trip circuit supervision scheme so that the operator can clearly differentiate via the available alarms between loss of supply due to a blown fuse / tripped MCB and failure of a trip circuit's supervision /faulty supervision wiring.

DC supply supervisión of the annuciation circuit shall be performed by the built in AC/DC fail relay of the Annunciator. Hence, the Annunciator shall be powered by dual source (with internal/external AC/DC changeover switch).

7.1.3.14.4 A.C. Supply Supervision

There shall be 1 (one) 240V A.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main AC supply entry point at terminal block with inscription "Main A.C. Supply Supervision relay" and shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration.
As per requirement mentioned in the section 7.1.3.12.2, 1 NO contact of the Main AC supply supervision relay & AC supply MCBs shall be used for AC supply healthy indication (if used) and 2 NC contact shall be used for AC supply faulty Annunciation & SAS integration.

7.1.3.15 MIMIC BUS

LED based Semaphore Indicator showing the position (open/close) of Circuit Breaker, Isolator and Earth Switch shall be inserted within the mimic bus.
Mimic bus material shall be brass, bronze or copper with enamel finished or anodized aluminum or plastic. The mimic bus and included symbols shall be shaped, colored and located as international standard. Light indicator showing position (opening/closing) of circuit breaker, DS, ES shall be installed. 33kV bus name (1,2,3,4..) shall be indicated with visible permanent sticker in the 33kV mimic bus.

Provision shall be made for 10 mm. wide painted and overall drawing mimic diagram by the purchaser on the exterior of the front panel board to represent the single line arrangement of the station equipment. Provision shall be made in such a way that centre line of the mimic bus shall be at a suitable height from the bottom of the PCM Panel.
Mimic bus material shall be brass, bronze or copper with enamel finished or anodized aluminum or plastic. The mimic bus and included symbols shall be shaped, colored and located as international standard. Light indicator showing position (opening/closing) of circuit breaker shall be installed.

The mimic bus shall be attached to the panel by mechanical devices, not with adhesive. Attachment shall be closely spaced to hold all parts of the mimic bus firmly to the panel face.

Mimic bus shall be provided with the following dimensions and color code:-

Voltage	Bus Color	Thick(mm)	Dimension (mm)
33 KV	Black	3	12
Earth	Green	3	12

7.1.3.16 Auxiliary Relay

Auxiliary relays with sufficient contact shall be used for transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank. etc.). Apart from these relays, each 33 kV PCM Cubicle shall be provided with 1 (one) set separate Auxiliary and signaling relay and wiring with fuses. This relay shall be used for control & monitoring of CB, DS and ES through numerical relay/BCU in case of SAS operation.

7.1.3.17 Annunciator

Each PCM panel shall be equipped with 1 (one) set Annunciator with sufficient windows (LED type with blinking facility) to display the alarms as per requirement. Annunciator shall have built in buzzer and AC/DC fail relay and shall be powered by dual source (with internal/external AC/DC changeover switch). Buttons for Accept, Mute, Test, Reset etc. shall be provided in the Annunciator.

7.1.3.18 Name plate & Ratings:

a) All instruments, relays and such other similar electrical devices mounted on the control and relay panel shall be provided with name plates bearing the manufacturer's name, serial identifying number and the Electrical rating data.

b) 25 mm wide name plates bearing suitable identification marks shall be fixed under the terminal wiring at the test blocks, at the fuse blocks and at the cable terminals. Similar plates shall be fixed on the exterior of the switch board in appropriate places to indicate function of control switches, push button etc. such as isolator control switch, breaker control switch, DC fail test, accept reset etc. Suitable identification marks shall be provided for individual casing part of the relays and other equipment.

c) 50mm wide plastic plate bearing suitable circuit description (which will be furnished after order is placed) etched in 30 mm size letters shall be provided for each panel and

mounted on the top of both outer and inner sides of the front and rear panels. These plates shall be removable type.

d) Each unit of control and relay panel shall be provided with a label located at the bottom on the front and shall contain the following details;

i. Manufacturer's name
ii. Year of Manufacturing
iii. Purchase Order Number/ Contract Number and date
iv. Technical Data
v. Serial Number/ Panel Number

7.1.3.19 PAINTING

Panel painting shall be done by the modern process of painting. All unfurnished surface of the steel panel and frame work shall be sand blasted or suitably cured to remove rust, scale, foreign adhering matter or grease. A suitable rust resisting primer shall be applied on the interior and exterior surface of steel, which shall be followed by application of an undercoat suitable to serve as base and binder forth finishing coat.

Details of Painting:-

Surface treatment	by seven tank process
Paint type	Powder coated. Pure polyester base grade A structure finish
Paint shade	RAL 7032 for external & internal surface
Paint thickness	Minimum 80 microns

7.1.3.20 SPECIFICATION OF 110V, 3 x 5(6) A, 3-PHASE, 4-WIRE, 3-ELEMENT, INDOOR TYPE MULTI-TARIFF PROGRAMMABLE METER WITH ASSOCIATED INSTRUMENT TRANSFORMERS ENCLOSED IN METERING PANEL

7.1.3.20.1 GENERAL

The meters are required for the purpose of energy metering of medium/high/extra-high voltage consumer metering at 132 kV or 33 kV or 11kV level . KWh is the unit for the purpose.

System voltage	Nominal service voltage 110V (PT Secondary), 3 phase 4wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	50 Hz

7.1.3.20.2 SPECIFICATION OF 110V 3 x 5(6)A, 3-PHASE, 4-WIRE 3-ELEMENT, INDOOR TYPE MULTI TARIFF PROGRAMMABLE DIGITAL ENERGY METER

The consumer meters are required for the purpose of energy metering of low voltage consumer who purchases power at 11 kV/33 kV line through PT & CT. kWh is the unit for revenue purpose.

System voltage	:	Nominal service voltage 110V, 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	:	50 Hz
Standard	:	The Energy Meter should be designed, manufactured and tested in accordance with IEC 62052-11, 62053-22 and 62053-23 or ANSI C 12.16, 12.10 (latest publication) or specified in this specification
Installation	:	Indoor Type
Type	:	Solid state.
Application	:	Registration of KWh (Peak & off-peak), Total KVarh(Q1+Q4), KW on 3- phase, 4-wire supply for balanced & unbalanced load (unidirectional). Peak 17.00-23.00. hrs and off peak 23.00-17.00 hrs (programmable) Bangladesh standard time. The software for Time of Use (TOU) shall be so developed to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
Connection	:	3-phase 4-wire, solidly grounded neutral.
Nos. of element	:	3 (Three)
Rated current	:	Basic current 5 amps and maximum current ≥6 amps.
Multiplication factor	:	The following shall be inscribe on the mater. Dial reading X CT ratio X PT ratio = Actual reading in KWh.
Register	:	Solid state LCD display type register. The display shall be programmable, automatic and include: • Meter ID • Time & date • Cumulative KWh (Peak & off-peak) • Cumulative Total KVarh (Q1+Q4) • Maximum demand (KW) with time & date • Cumulative Maximum demand (kW) for billing month.

Maximum demand (MD) in kW shall be registered using the technique of cumulating on integration period controlled by built-in process and the MD shall be continuously recorded and the highest shall be indicated. The highest MD shall be added to the cumulative store, which shall be automatically initiated after an interval of one month / one billing period by means of built-in timing device.

- Integration period: 30 (thirty) minutes.

- Number of MD reset (Automatic& manually).
- Average PF for billing period.

Instantaneous:

- Phase voltage with indication
- Phase amps with direction.
- Power factor (average).
- Demand (KW)
- Voltage phase angel (each phase)
- Current phase angle(each phase)
- Tampering indication in the register.

Memory storage : The meter shall have sufficient capacity (minimum 400 KB) to store the following readings and data in non-volatile memory even in case of power failure.

- Equipment identification codes, security codes and access codes.
- Number of power interruption with date & time (minimum 100 events).
- Latest power failure time & date
- Date & time of meter tempering. (Voltage & Current missing, demand reset , time change).
- Event logs
- Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4)
- Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence.

The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 180 (One hundred eighty) days.

- Load Profile data [kWh, KVarh (Q1+Q4)
- Phase voltage or Vh
- Phase amps or Ah

Accuracy class : Accuracy class is 0.2s (point two s) for active energy (kwh) & 0.5s for reactive energy (Kvar).

Number of digit Minimum 5 (Five) integer with 3 (three) decimal (Total 8 digit).

Type of Display Solid-state LCD display.

Time switch : The time switch shall be built-in type and shall be designed to perform a present cycle of operation. Time switch shall reset MDI at the end of every month (billing period) automatically. In the event of

failure of power supply and battery, at the same time set memory shall not be lost i.e. the set program shall be recorded in non-volatile memory. The maximum error shall be kept within ± 1 (one) second per day. Time error adjustment facility shall be provided.

Battery reserve : Each time switch must be provided with lithium battery which allow the switch to function for a period of not less than 10 (ten) years. The guaranteed life of the battery should not be less than 10 (ten) years and shall have provision for easy replacement. The shelf life of the battery should be minimum 15(fifteen) years or more.

Construction : The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic /phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to accommodate both padlock and wire type seal.

IEC meters shall be minimum IP51. The ANSI Standard meter shall be effectively sealed to prevent entrance of rain and dust into its internal parts. The meter shall pass Rain test described in underwriter's laboratory standard UL-50 (USA) for type 3 enclosures. A general purpose finish of class 1 as specified in section 7 of ANSI C12.10 shall be provided for the meter and it shall meet the requirement of weather simulation test (Sec. 7.2.1 of ANSI C12.10) and salt spray test (ASTM B117). It shall be designed to operate continuously for the normal life of the meter in unsheltered outdoor tropical location exposed to the elements without corrosion or other damage to parts to adversely affect meter accuracy or reliability.

Enclosure for IEC Standard Meter

The meter may be surface mounted in an outdoor pole mounted metering enclosure box with necessary wiring. The enclosure box should be made either of high quality flame retardant ABS Resin of minimum 3 mm thickness or of galvanized sheet steel of minimum 1.22 mm (18 SWG) thickness or of auto extinguishable, shockproof and UV resistant, hot molded glass reinforced polyester of minimum 3 mm thickness. The box shall have hinged front door with one toughened glass window or transparent UV resistant Polly carbonate to enable easy reading of meter. The metering box shall be weather proof, dust proof, rodent and inspect proof in accordance with enclosure classification IP54. Service cable entry and exit will be

sides of the box and 40 (forty) mm diameter hole with black PVC conic cable gland shall be provided for side entry & exit for this purpose. All material parts shall have anti-corrosive protection.
All materials shall be designed, manufactured and tested as per IEC or equivalent International standards except as mentioned. The front door shall be removable and provision must be made for sealing in the closed position.

Socket	:	Meter sockets shall be suitable for installation of offered type meter. Meter sockets shall be 3-phase, 4-wire wye, 600 volt class, made from 16 gauge sheet metal. Meter sockets shall be similar except as described below. Meter sockets shall approximately 14″ (35.6 cm) H×9″(22.9cm) W×4″ (10.2 cm) D and rectangular in shape. Sockets shall be the same size as 1-phase sockets and terminal blocks shall be interchangeable. Sockets shall be ring less type, sealing latch to be stainless steel and have adequate means for socket grounding. Meter socket shall have a 2″(5 cm) Diameter top opening complete with a 1- ¼″ (3.2 cm) hub. Meter socket shall have 4 knockouts with a range up to 2″(5 cm) Diameter, one on the back, one in the bottom and one in each side. Meter socket shall comply with ANSI C 12.6, 12.10 The Socket shall have written permanently (not in paper printed) "connection diagram" distinctly marked in addition to all standard data.
Terminal	:	Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.
Connection	:	3-phase, 4-wire solidly grounded neutral.
Service life of meter	:	Shall be minimum 15 (fifteen) years.
Visual indication of operation	:	Pulse indicator on the front of meter as per meter constant.
Special condition	:	a) The factory calibration conforms to relevant IEC or equivalent international standard. LCD display shall be shown consecutively and continuously one after another. The display shall be automated i.e. no external means shall be required to see the display. Each display shall last for at least 5 (five) sec.

b) Meter Electronic Circuit biasing voltage shall have to be ensured from each phase to phase and each phase to neutral and minimum basing voltage 40V.

Meter Sealing : The Energy meter body will be hermetically sealed or ultrasonically welded to avoid unauthorized opening of meter cover. Otherwise the bid will be rejected.

Communication port : The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard.

Remote Communication : The meter shall be equipped with external GSM-GPRS Modem, which will be able to interface with RS232/RS485 for data communication with the central server from meters, having all accessories like power supply adapter, necessary connecting cables, antenna with minimum 2.5 meter extension cable, connectors, enclosure box with fixing materials etc. The modem shall be compatible with existing AMR system of BPDB.

7.1.3.20.3 TAMPER AND FRAUD PROTECTION FEATURE:

The meter shall have the following features to prevent/detect tamper and fraud:

- **Phase Sequence Reversal:** The meter should work accurately irrespective of phase sequence of supply.
- **Missing Potentials:** The meter shall be capable of detection occurrence of missing potential of one phase or two phase(s), which can happen due to intentional/accidental disconnection of potential link(s).
- **Terminal cover** must have micro-switch provision to monitor unauthorized opening. Opening of terminal cover shall trigger an event to be recorded in the event log memory.
- **Software Access:** Software access for configuration and setting of the meters.

7.1.3.20.4 TECHNICAL FEATURE

- The body cover and socket / enclosure shall be provided security sealing provisions to prevent unauthorized access to the internal meter works.
- The meter shall be provided with connection diagram.
- The data access should be protected by minimum 3(three) steps software password in meter.
- The meter shall have provision of phase to phase and each phase to neutral biasing.

- The meter shall have minimum biasing voltage of 40V otherwise the bid will be rejected.
- The meter and socket/enclosure shall have provision of earthing.
- Meter must operate and accurately register demand and energy when service voltage is applied across any two of the three input terminals or when service voltage is applied from any input terminal to neutral. Meter will continue to operate even the neutral is missing.
- The meter and socket/ enclosure must be the same country of origin other wise the bid will be rejected.
- The registration of KWh (Peak & off-peak) on 3-phase, 4-wire supply for balanced & unbalanced load will be unidirectional. i.e. if one, two or three phase supply is/are reversed, it will take the absolute (kWh-del) + absolute (kWh-rev) and will add them together as total 3-phase KWh.
- The meter shall be equipped with remote GSM & PSTN communication option.
- It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850
- The meter shall have permanently print nameplate distinctly marked with the following in addition to all standard data:
    1. The word "BPDB" and insignia of BPDB.
    2. Voltage and current rating.
    3. Frequency.
    4. Number of element, number of wire and multiplication factor.
    5. Accuracy class.
    6. Year of manufacture.
    7. Serial number.
    8. Name of manufacturer.
    9. Meter constant.

7.1.3.20.5 Display of measured values/ Meter Display

- The Sequence of LCD display should be user programmable.
- The contrast setting of LCD display should be visible in different lighting environment and distinctly visible in broad daylight.
- The meter should be of displaying time and date, the direction of energy i.e. as import/export or +/-, active tariff and internal fault indicators.
- There should be up to three groups of display to priorities the display. Each showing a programmable function group.

7.1.3.20.6 Meter Parameterisation Software

- The parameterisation software must run on Windows operating environment.
- The software must be protected by software keys to control duplication and installation.
- The software should have a customizable printing feature by task list.

- The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase (voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 8(eight) Channels data stored in different interval for 90 days.
- Tamper feature: The meter must have Errors & Warnings codes, History log and Event log (minimum 400 events) to record date & time of all power outages, demand resets, time change.
- In addition, each software key must bear a unique user ID and that is not transferable to another PC that has different user ID.
- The Meter should be able to display the phasor diagram.
- The software for Time of Use (TOU) shall be compatible to accommodate future tariff and can be customized, if the purchaser changes the tariff .The software shall be compatible with Windows operating system.
- The Meter must be provided with meter passwords to secure communication between meter software and meter having minimum 3(three) access levels.
- The AMR Softwares have to be compatible with BPDB's existing AMR System. The Tenderer have to develop the total AMR System with exiting and supplied AMR Solution. In this case the tenderer have to provide their meter protocols so that all exiting meters and supplied meters data will be downloaded and managed in a single AMR System.

7.1.3.20.7 EXTERNAL MODEM WITH ACCESSORIES

GSM/GPRS modem with RS-232/RS-485 ports, meter interfaced power supply, connection cables, antenna with minimum 2.5 meters cable, mounting facilities, enclosure (if necessary). The modems will be capable of GSM and GPRS connectivity simultaneously. For GSm configuration the AT command will be available and for GPRS communication the APN, reset time, username, password, port number, etc. are configurable. The modem will have the following specification.

Interruption (< 1 ms), RS-232 (at least 1), GPRS class 10, operating band 900/1800, auto reset capability (with phone call, SMS). The modem will be robust, durable and compatible with the employers existing service condition.

7.1.3.20.8 Manufacturer

All the energy meter shall be supplied from any of the following Country: -

a) European Country.
b) North American Country.
c) Japan
d) Australia

The tenderer should submit authentic document with the tender against the country and location of the offered Electric Energy Meter Manufacturing plant which will be verified during tender evaluation.

Note: Related software & accessories if required for Energymeters is within the scope of supply.

7.1.3.20.9 PROTECTIVE RELAYS

All Protective relays & Auxiliary relays shall be numerical programmable type and shall comply relevant IEC or equivalent international standard. Contract arrangement of the relays should conform to the requirements of the diagram.

All the protective relays shall be supplied from any of following manufacturers:

1. ABB (Switzerland/Finland/ Sweden)
2. Siemens (Germany/ Switzerland)
3. Schneider (France/UK)
4. Alstom (UK/France)
5. NR, China
6. SEL, USA

Note: Related software & accessories if required for Energymeters is within the scope of supply.

7.1.3.20.10 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components (i.e. breakers, vacuum interrupter etc.) of offered type equipment.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc for performing Routine Test as per IEC standard.
d) Manufacturer's ISO 9001 Certificate.

7.1.3.20.11 APPROVAL OF DRAWINGS

The successful bidder/tenderer shall submit the following drawings in AutoCAD format and in hard copy for the approval to the Engineer, Director, Design & Inspection–II, BPDB within within 15 days from the date of signing Contract.

1. Technical Specification and Guaranteed Technical

2. Detailed dimensional drawings of 33KV Switchgear including foundation drawing. with cable slots showing all equipment mounted on them along with complete panel wise list of equipment and list of Name Plates. Weight of these panels with all the equipment mounted on these shall also be furnished in the Drawing.

3. Outlined drawings of internal wiring diagram of the instrument, relays, meters, annunciator and other equipment showing external terminal connections with the equipment terminal number.

4. Complete AC and DC Schematic diagram of 33KV Switchgear Panels to indicate the followings:
   i) Annunciator circuit
   ii) Protection and control circuit
   iii) Indication and Supervision circuit
   iv) Other circuits as necessary

These drawings shall show AC power connection and Secondary connections for relays, meters, terminal blocks with their number etc. interconnection diagram between PCM and circuit breaker, Power and Instrument Transformer and other equipment as necessary

5. Cabling and wiring diagram of the cubicles and inter-connections between them. Ferrule numbers, device number and grouping for cable take off shall be distinctly shown. No work shall be performed in connection with the fabrication and manufacture of the testing equipment until the technical data and drawings have been approved.

6. Manufacturer's printed catalogue describing the type/model of offered 33KV Switchgear, Protective relays, Energy Meters

7. The Bidder shall have to submit 3 (three) sets of the same for Approval. The bidder shall also submit one set reproducible tracing of the above drawings in soft format.

8. List of switchgears electrical & mechanical interlock, BCPU/Relay's BI, BO, LED, Annunciators window and related drawings shall be submitted with detail switchgear drawing during approval stage.

No work shall be performed in connection with the fabrication and manufacture of the Testing Equipment until the technical data and drawings have been approved. The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. The cost of supplying drawings and specifications shall be borne by the supplier.

At the time of delivery of Equipment, the supplier shall supply three (3) sets of all approved technical data and drawings in bound book form along with manufacturer's original catalogue of the Equipment to the office of Director, Design & Inspection-II, BPDB, 9/B, Motijheel C/A, Dhaka, Bangladesh, Telephone # 88-02-9550404

7.1.5 SPECIFICATION OF 110V, 3 x 5(6) A, 3-PHASE, 4-WIRE, 3-ELEMENT, INDOOR TYPE MULTI-TARIFF PROGRAMMABLE METER WITH ASSOCIATED INSTRUMENT TRANSFORMERS ENCLOSED IN METERING PANEL.

7.1.5A GENERAL

The meters are required for the purpose of energy metering of medium/high/extra-high voltage consumer metering at 132 kV or 33 kV or 11kV level . KWh is the unit for the purpose.

System voltage	Nominal service voltage 110V (PT Secondary), 3 phase 4wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	50 Hz

7.1.5.B SPECIFICATION OF 110V 3 x 5(6)A, 3-PHASE, 4-WIRE 3-ELEMENT, INDOOR TYPE MULTI TARIFF PROGRAMMABLE DIGITAL ENERGY METER

The consumer meters are required for the purpose of energy metering of low voltage consumer who purchases power at 11 kV/33 kV line through PT & CT. kWh is the unit for revenue purpose.

System voltage	:	Nominal service voltage 110V, 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	:	50 Hz
Standard	:	The Energy Meter should be designed, manufactured and tested in accordance with IEC 62052-11, 62053-22 and 62053-23 or ANSI C 12.16, 12.10 (latest publication) or specified in this specification
Installation	:	Indoor Type
Type	:	Solid state.
Application	:	Registration of KWh (Peak & off-peak), Total KVarh(Q1+Q4), KW on 3- phase, 4-wire supply for balanced & unbalanced load (unidirectional). Peak 17.00-23.00. hrs and off peak 23.00-17.00 hrs (programmable) Bangladesh standard time. The software for Time of Use (TOU) shall be so developed to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
Connection	:	3-phase 4-wire, solidly grounded neutral.
Nos. of element	:	3 (Three)
Rated current	:	Basic current 5 amps and maximum current ≥6 amps.
Multiplication factor	:	The following shall be inscribe on the mater. Dial reading X CT ratio X PT ratio = Actual reading in KWh.
Register	:	Solid state LCD display type register. The display shall be programmable, automatic and include: • Meter ID • Time & date • Cumulative KWh (Peak & off-peak) • Cumulative Total KVarh (Q1+Q4)

- Maximum demand (KW) with time & date
- Cumulative Maximum demand (kW) for billing month.

Maximum demand (MD) in kW shall be registered using the technique of cumulating on integration period controlled by built-in process and the MD shall be continuously recorded and the highest shall be indicated. The highest MD shall be added to the cumulative store, which shall be automatically initiated after an interval of one month / one billing period by means of built-in timing device.

- Integration period: 30 (thirty) minutes.
- Number of MD reset (Automatic& manually).
- Average PF for billing period.

Instantaneous:

- Phase voltage with indication
- Phase amps with direction.
- Power factor (average).
- Demand (KW)
- Voltage phase angel (each phase) or P.F. Angle(each phase)
- Current phase angle(each phase)
- Tampering indication in the register.

Memory storage : The meter shall have sufficient capacity (minimum 400 KB) to store the following readings and data in non-volatile memory even in case of power failure.

- Equipment identification codes, security codes and access codes.
- Number of power interruption with date & time (minimum 100 events).
- Latest power failure time & date
- Date & time of meter tempering. (Voltage & Current missing, demand reset , time change).
- Event logs
- Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4)
- Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence.

The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 180 (One Hundred Eighty) days.

- Load Profile data [kWh, KVarh (Q1+Q4)
- Phase voltage or Vh
- Phase amps or Ah

Accuracy class : Accuracy class is 0.2s (point two s) for Active Energy(KWH) & 0.5s

		for reactive Energy (KVARH)
Number of digit		Minimum 5 (Five) integer with 3 (three) decimal (Total 8 digit).
Type of Display		Solid-state LCD display.
Time switch	:	The time switch shall be built-in type and shall be designed to perform a present cycle of operation. Time switch shall reset MDI at the end of every month (billing period) automatically. In the event of failure of power supply and battery, at the same time set memory shall not be lost i.e. the set program shall be recorded in non-volatile memory. The maximum error shall be kept within ± 1 (one) second per day. Time error adjustment facility shall be provided.
Battery reserve	:	Each time switch must be provided with lithium battery which allow the switch to function for a period of not less than 10 (ten) years. The guaranteed life of the battery should not be less than 10 (ten) years and shall have provision for easy replacement. The shelf life of the battery should be minimum 15(fifteen) years or more.
Construction	:	The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic /phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to accommodate both padlock and wire type seal. IEC meters shall be minimum IP51. The ANSI Standard meter shall be effectively sealed to prevent entrance of rain and dust into its internal parts. The meter shall pass Rain test described in underwriter's laboratory standard UL-50 (USA) for type 3 enclosures. A general purpose finish of class 1 as specified in section 7 of ANSI C12.10 shall be provided for the meter and it shall meet the requirement of weather simulation test (Sec. 7.2.1 of ANSI C12.10) and salt spray test (ASTM B117). It shall be designed to operate continuously for the normal life of the meter in unsheltered outdoor tropical location exposed to the elements without corrosion or other damage to parts to adversely affect meter accuracy or reliability.
Enclosure for IEC Standard Meter		The meter shall be surface mounted in an outdoor pole mounted metering enclosure box with necessary wiring. The enclosure box should be made either of high quality flame retardant ABS Resin of minimum 3 mm thickness or of galvanized sheet steel of minimum 1.22 mm (18 SWG) thickness or of auto extinguishable, shockproof and UV resistant, hot molded glass reinforced polyester of minimum

3 mm thickness. The box shall have hinged front door with one toughened glass window or transparent UV resistant Polly carbonate to enable easy reading of meter. The metering box shall be weather proof, dust proof, rodent and inspect proof in accordance with enclosure classification IP54. Service cable entry and exit will be sides of the box and 40 (forty) mm diameter hole with black PVC conic cable gland shall be provided for side entry & exit for this purpose. All material parts shall have anti-corrosive protection.

All materials shall be designed, manufactured and tested as per IEC or equivalent International standards except as mentioned. The front door shall be removable and provision must be made for sealing in the closed position.

Socket	:	Meter sockets shall be suitable for installation of offered type meter. Meter sockets shall be 3-phase, 4-wire wye, 600 volt class, made from 16 gauge sheet metal. Meter sockets shall be similar except as described below. Meter sockets shall approximately 14″ (35.6 cm) H×9″(22.9cm) W×4″ (10.2 cm) D and rectangular in shape. Sockets shall be the same size as 1-phase sockets and terminal blocks shall be interchangeable. Sockets shall be ring less type, sealing latch to be stainless steel and have adequate means for socket grounding. Meter socket shall have a 2″(5 cm) Diameter top opening complete with a 1- ¼″ (3.2 cm) hub. Meter socket shall have 4 knockouts with a range up to 2″(5 cm) Diameter, one on the back, one in the bottom and one in each side. Meter socket shall comply with ANSI C 12.6, 12.10 The Socket shall have written permanently (not in paper printed) “connection diagram” distinctly marked in addition to all standard data.
Terminal	:	Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.
Connection	:	3-phase, 4-wire solidly grounded neutral.
Service life of meter	:	Shall be minimum 15 (fifteen) years.
Visual indication of operation	:	Pulse indicator on the front of meter as per meter constant.

Special condition	:	c) The factory calibration conforms to relevant IEC or equivalent international standard. LCD display shall be shown consecutively and continuously one after another. The display shall be automated i.e. no external means shall be required to see the display. Each display shall last for at least 5 (five) sec. d) Meter Electronic Circuit biasing voltage shall have to be ensured from each phase to phase and each phase to neutral and minimum basing voltage 40V.
Meter Sealing	:	The Energy meter body will be hermetically sealed or ultrasonically welded to avoid unauthorized opening of meter cover. Otherwise, the bid will be rejected.
Communication port	:	The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard.
Remote Communication	:	The meter shall be equipped with external GSM-GPRS Modem, which will be able to interface with RS232, RS485 for data communication with the central server from meters, having all accessories like power supply adapter, necessary connecting cables, antenna with minimum 2.5 meter extension cable, connectors, enclosure box with fixing materials etc. The modem shall be compatible with existing AMR system of BPDB.

7.1.5. C. TAMPER AND FRAUD PROTECTION FEATURE:

The meter shall have the following features to prevent/detect tamper and fraud:

- **Phase Sequence Reversal:** The meter should work accurately irrespective of phase sequence of supply.
- **Missing Potentials:** The meter shall be capable of detection occurrence of missing potential of one phase or two phase(s), which can happen due to intentional/accidental disconnection of potential link(s).
- **Terminal cover** must have micro-switch provision to monitor unauthorized opening. Opening of terminal cover shall trigger an event to be recorded in the event log memory.
- **Software Access:** Software access for configuration and setting of the meters.

7.1.5.D TECHNICAL FEATURE

- The body cover and socket / enclosure shall be provided security sealing provisions to prevent unauthorized access to the internal meter works.
- The meter shall be provided with connection diagram.
- The data access should be protected by minimum 3(three) steps software password in meter.
- The meter shall have provision of phase to phase and each phase to neutral biasing.

- The meter shall have minimum biasing voltage of 40V otherwise the bid will be rejected.
- The meter and socket/enclosure shall have provision of earthing.
- Meter must operate and accurately register demand and energy when service voltage is applied across any two of the three input terminals or when service voltage is applied from any input terminal to neutral. Meter will continue to operate even the neutral is missing.
- The meter and socket/ enclosure must be the same country of origin other wise the bid will be rejected.
- The registration of KWh (Peak & off-peak) on 3-phase, 4-wire supply for balanced & unbalanced load will be unidirectional. i.e. if one, two or three phase supply is/are reversed, it will take the absolute (kWh-del) + absolute (kWh-rev) and will add them together as total 3-phase KWh.
- The meter shall be equipped with remote GSM & PSTN communication option.
- It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850
- The meter shall have permanently print nameplate distinctly marked with the following in addition to all standard data:
    1. The word "BPDB" and insignia of BPDB.
    2. Voltage and current rating.
    3. Frequency.
    4. Number of element, number of wire and multiplication factor.
    5. Accuracy class.
    6. Year of manufacture.
    7. Serial number.
    8. Name of manufacturer.
    9. Meter constant.

7.1.5.E. Display of measured values/ Meter Display

- The Sequence of LCD display should be user programmable.
- The contrast setting of LCD display should be visible in different lighting environment and distinctly visible in broad daylight.
- The meter should be of displaying time and date, the direction of energy i.e. as import/export or +/-, active tariff and internal fault indicators.
- There should be up to three groups of display to priorities the display. Each showing a programmable function group.

7.1.5.F Meter Parameterisation Software

- The parameterisation software must run on Windows operating environment.
- The software must be protected by software keys to control duplication and installation.
- The software should have a customizable printing feature by task list.
- The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase

(voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 8(eight) Channels data stored in different interval for atleast 180 days.

- Tamper feature: The meter must have Errors & Warnings codes, History log and Event log (minimum 400 events) to record date & time of all power outages, demand resets, time change.
- In addition, each software key must bear a unique user ID and that is not transferable to another PC that has different user ID.
- The Meter should be able to display the phasor diagram.
- The software for Time of Use (TOU) shall be compatible to accommodate future tariff and can be customized, if the purchaser changes the tariff .The software shall be compatible with Windows operating system.
- The Meter must be provided with meter passwords to secure communication between meter software and meter having minimum 3(three) access levels.
- The AMR Software have to be compatible with BPDB's existing AMR System. The Tenderer have to develop the total AMR System with exiting and supplied AMR Solution. In this case the tenderer have to provide their meter protocols so that all exiting meters and supplied meters data will be downloaded and managed in a single AMR System. AMR should have remote communication GPRS.

7.1.5.F2 EXTERNAL MODEM WITH ACCESSORIES

GSM/GPRS modem with RS-232/RS-485 ports meter interfaced power supply, connection cables, antenna with minimum 2.5 meters cable, mounting facilities, enclosure (if necessary). The modems will be capable of GSM and GPRS connectivity simultaneously. For GSm configuration the AT command will be available and for GPRS communication the APN, reset time, username, password, port number, etc. are configurable. The modem will have the following specification.

Interruption (< 1 ms), RS-232 (at least 1), GPRS class 10, operating band 900/1800, auto reset capability (with phone call, SMS). The modem will be robust, durable and compatible with the employers existing service condition.

7.1.5.F3 Manufacturer

All the energy meter shall be supplied from any of the following Country: -

a) European Country.
b) North American Country.
c) Japan
d) Australia

The tenderer should submit authentic document with the tender against the country and location of the offered Electric Energy Meter Manufacturing plant which will be verified during tender evaluation.

Note: Related software & accessories if required for Energy meters is within the scope of supply.

7.1a TECHNICAL SPECIFICATIONS FOR 11 KV GIS SUBSTATION SWITCHGEAR

7.1a.1 Scope

This clause describe the General Technical Requirements for the new 11KV indoor gas insulated Switchgear and general switchyard equipment, and shall be read in conjunction with the Tender Requirements, Schedules and Drawings in the specification.

The Supplier shall demonstrate that the switchgear has been designed, built and installed in accordance with the relevant international standards and the specification. It shall also operate and perform on a site in accordance with the requirements of the specification and in the environment defined herein.

The design shall be proven by the submission at the time of Tender of test certificates covering all specified tests deemed to be pertinent to the plant and to the conditions in which it will operate or, if such test certificates cannot be supplied or are deemed unacceptable by the Engineer, type tests which will be subject to the conditions of this Contract shall be carried out at no extra cost to the Employer.

The requirement for switchgear spares, tools and appliances, including test, maintenance and handling equipment shall be as stated in the Bid document. All devices necessary for operation and earthing shall be provided within the Contract Price.

7.1a.2 References

7.1a.2.1 British Standards

BS	159	Specifications for HV bus bars and bus bar connections
BS	1977	Specifications for high conductivity copper tubes for electrical
BS	2898	Specifications for wrought aluminium for electrical purposes. Strip with
BS	3938	drawn or rolled edges.
BS	5253	Specifications for AC disconnectors and earthing switches.
BS	6651	Lightning Protection
BS	7354	Code of practice for design of HV open terminal stations.

7.1a.2.2 IEC Standards

1.	IEC 62271	HV Switchgear and Controlgear.
2.	IEC 60376	Specification and acceptance of new sulphur hexafluoride
3.	IEC 60480	Guide to checking of sulphur hexafluoride taken from electrical equipment.
4.	IEC 60060	High Voltage test techniques.
5.	IEC 60071	Insulation Co-ordination
6.	IEC 60099-5	Surge arresters Part 5: Selection and application recommendation
7.	IEC 60129	AC disconnectors (isolators) and earthing switches
8.	IEC 60044-1	Current transformers.
9.	IEC 60044-2	Voltage transformers.
10.	IEC 60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.

11.	IEC 61850	Communication network and system in substation
12.	IEC 60529	Degrees of protection provided by Enclosure (IP code)
13.	IEC 60255	Electrical relays
14.	IEC 62271-1	High voltage switchgear and control gear: common specification
15.	IEC 62271-100	High voltage switchgear and control gear: Part 100: Alternating current circuit breakers
16.	IEC 62271-102	High voltage switchgear and control gear: Part 102: Alternating current disconnector and earthing switch

1) 7.1a.3 11 KV GIS INDOOR METAL CLAD SWITCHGEAR

7.1a.3.1 General

The 11 kV switchgear shall consist of a single bus-bar, metal clad, indoor type, floor mounted, single tier integrated unit, incorporating enclosures for the circuit breaker units, bus-bars, current transformers and auxiliary wiring. The switchgear shall be made according to IEC62271-200.

Each 11 kV CB shall be provided with a combined relay & control panel forming an intregral part of the circuit breaker equipment.

The panels shall be equipped with the necessary protection control devices, indicating instruments and alarming devices, separate MCBs for power supply of protection device, measuring devices and others, etc.

The switchgear shall be of robust construction designed for maximum reliability of service in the tropical climate specified.

Cable boxes shall be supplied complete with glands and terminal lugs. Cable termination shall be totally insulated. Facility with necessary accessories for plug-socket connection of at least two cables per phase shall be provided. Sealing/cap for unused cable termination shall also to be provided.

7.1a.3.1.1

1.	Installation	Indoor
2.	Bus-bar Scheme	Single bus bar
3.	Construction	The structure of the cell is made of special sheet clad with convenient treatment which in all respect resists the effected of indoor humid tropicalized climate.
4.	System	3-Phase, 3-Wire with earthed Neutral
5.	Nominal System Voltage	11 kV Phase to Phase
6.	System Highest Voltage	12 kV Phase to Phase
7.	Rated short duration power frequency	28 kV (rms)

	withstand voltage	
8.	Rated Lightning Impulse withstand voltage	75 kV (peak)
9.	Frequency	50 Hz
10.	Rated normal current:	
11.	a) **for 20/26 & 16/20 MVA power transformer 11kV Incoming & Bus Coupler**	**2500A**
	b) **for 11KV outgoing feeder with 2500A bus bars**	**630A**
	Temperature rise of any part of the switchgear & control gear	Shall be as per the latest revision of relevant IEC standards.
12.	Rated Short-time withstand Current (Rated short circuit breaking current)	25 KA for 3 Sec.
13.	Rated Peak withstand Current (Rated short circuit making current)	62.5 KA
14.	Opening Time	≤ 0.05 Sec.
15.	Breaking Time	≤ 5 Cycle
16.	Closing Time	≤ 5 Cycle
17.	Rated supply voltage of closing & opening and auxiliary circuits (heating, lighting, motor).	110 V DC & 240/415 V AC (respectively).
18.	Rated Operating Sequence	0-0.3sec-CO-3Min-CO
19.	Degrees of Protection by enclosures (IP)	IP4X as defined in IEC 60529
20.	All Current Carrying Parts of Switchgear	Shall be made of copper
21	Dimensions of all 11kV Cubicles (including bus bar height and size)	Shall be matched in all respect.
22.	Three position disconnector Switch (Motorized & Manual)	Rated Voltage 12 kV, Rated current 2500A for Incomer & Bus Coupler and 630A for Outgoing feeder, Rated short time curren 25 kA, Short time current rated duration 3sec, Switch Position close, open, earth. Electrical and Mechanical interlock as per IEC 62271-200.
23.	Standard	Design, Manufacture, Testing and Performance shall be in accordance to the IEC-62271-200 and other related IEC standards.

7.1a.4.1.2 11KV TRANSFORMER INCOMING CUBICLES, EACH PANEL COMPRISING:

1.	Type of Bus Bar	HDHC copper 2500A.
2.	Bus Bar Scheme	Single Bus Bar

3.	Number of Phases	3 (Three)
4.	Operating Mechanism	For Circuit Breaker operation, spring-operated and stored-energy mechanisms shall be available. With manual Power/Manual, Trip Free, Electrically Spring operated by 240 Vac motor and shunt trip by 110 Vdc from storage battery, there shall be 2 Nos. Trip coils. The operating sequence OPEN-CLOSE-OPEN is stored in the springs.
5.	Rupturing Capacity.	500 MVA, Symmetrical.
6.	Breaking Time.	5 Cycle Maximum
7.	Continuous Current Rating.	2500 A
8.	All Current Carrying Parts of Switchgear.	Shall be made of Copper
9.	AC Control Voltage.	240 ± 10% Volts
10.	DC Control Voltage.	110 ± 10% Volts
11.	Cable and Boxes for Incoming.	Suitable for size 2x1Cx500 mm^2 XLPE 11kV cables per phase with copper conductors.
12.	Single Phase Current Transformer with Ratio 900-1800/5-5-5A of accuracy class & burden 0.2, 15 VA for measuring core (1st core) and 5P20, 15 VA for protection core (2nd & 3rd core). (Characteristics: Epoxy resins insulated and double windings, butyl rubber type. The epoxy resin should be ultraviolet stabilized, fungus resistant & high tracking resistance, short time current ratings 25KA for 3 second & extended current ratings 120% of the rated value, secondary double winding, installation shall be in the panel).	3 Nos. (A Phase, B Phase & C Phase Shall have Individual CT)

<table>
<tr><td>13.</td><td>Numerical, programmable Over Current and Earth fault Protection relay and separate Standby Earth fault and all other necessary features for transformer incoming feeder protection. The current setting range of the O/C & E/F relay shall be from 0.1*I_n to 30*I_n for both overcurrent and earth fault element. All O/C & E/F relays (3 O/C element + 1 E/F element) shall have both IDMT, DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability. O/C & E/F relays for 11 kV Transformer Incoming Cubicles shall have directional (67P, 67N) features as well. The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation</td><td>1 set</td></tr>
<tr><td>14.</td><td>Master Trip & Trip Circuit Supervision (for each trip coil) relays.</td><td>1 Set</td></tr>
<tr><td>15.</td><td>All necessary Auxiliary & Signaling relays.</td><td>As required by BPDB.</td></tr>
<tr><td>16.</td><td>Numerical Programmable 3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWH Meter of accuracy class 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, per phase & total KW with maximum demand, KVar, Power factor etc.</td><td>1 No.</td></tr>
<tr><td>17.</td><td>Indicating analogue ampere meter flush mounting type with dual scales option (0-900A/1800A) for connecting to the current transformer ratio 900-1800/5-5-5A.</td><td>3 Nos.</td></tr>
<tr><td>18.</td><td>70W, 240V AC, Single Phase space heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater</td><td>1 set</td></tr>
<tr><td>19.</td><td>All necessary AC DC MCB, TNC Switch, Selector Switch, Limit Switch, Control Switch, Toggle Switch, Link/ Base, Push Button, Indicating/ Illumination Lamp, AC Plug Socket, Wiring, Fuses, Hooter etc. i.e. complete in all respect. Mimic diagram with LED based Semaphore Indicator for Isolator/Breaker/Earth switch position.</td><td>As required.</td></tr>
<tr><td>20.</td><td>11 kV bus incomer Switchgear panel (16 window Annunciator)
<table><tr><th>Main DC Fail</th><th>AC Fail</th><th>Main Relay Faulty</th><th>PT Failure</th></tr></table></td><td></td></tr>
</table>

		TCS-1 Unhealthy	**TCS-2 Unhealthy**	**O/C Trip**	**E/F Trip**
		67 Trip	**67N Trip**	**Standby E/F**	**33 kV Inter trip**
		Trip relay operated	**Gas fault**	**Spring Charge Fail**	**SCADA/ Remote Trip**
21.	11kV PT: For All the 11kV (Each) Bus Section (1 set-Bus VT) (Can be installed in any Feeder panel or in separate Panel): 11 KV /√3: 110V /√3, 110V/√3 for each phase with accuracy class & Burden- **0.2, 20VA** for measuring core and **3P, 20VA** for protection core (A Phase, B Phase & C Phase Shall have Individual PT)				1 set
22.	Indicating analogue voltmeter with six position selector switch flush mounting with scales 0-15 kV for connection to potential transformer ratio (11/√3)/(0.11/√3)/(0.11/√3) kV, (50 Hz).				1 set
23.	Capacitive Voltage Divider (CVD) based Live Line Indicator (LLI) system.				1 set

7.1a.4.1.3 BUS COUPLER WITH BUS RISER CUBICLES EACH COMPRISING:

1.	Type of Bus Bar	HDHC copper 2500A.
2.	Bus Bar Scheme	Single Bus Bar
3.	Number of Phases	3 (Three)
4.	Operating Mechanism	For Circuit Breaker operation, both spring-operated and stored-energy mechanisms shall be available. With manual Power/Manual, Trip Free, Electrically Spring wound operated by 240 Vac and shunt trip by 110 Vdc from storage battery, there shall be 2 Nos. Trip coils. The operating sequence OPEN-CLOSE-OPEN is stored in the springs.
5.	Rupturing Capacity	500 MVA, Symmetrical
6.	Breaking Time	5 Cycle Maximum
7.	Continuous Current Rating	2500 A
8.	All Current Carrying Parts of VCB	Shall be made of Copper
9.	AC Control Voltage	240 ± 10% Volts
10.	DC Control Voltage	110 ± 10% Volts

11.	Single Phase Current Transformer with Ratio 900-1800/5-5A of accuracy class & burden 0.2, 15 VA for measuring core (1st core) and 5P20, 15 VA for protection core (2nd core) (Characteristics: Epoxy resins insulated and double windings, butyl rubber type. The epoxy resin should be ultraviolet stabilized, fungus resistant & high tracking resistance, short time current ratings 25KA for 3 sec. & extended current ratings 120% of the rated value, secondary double winding, installation shall be in the panel).	3 Nos. (A Phase, B Phase & C Phase Shall have Individual CT)
12.	Numerical programmable Over Current and Earth fault protection relay with all necessary features for Bus Coupler protection. The current setting range of the O/C & E/F relay shall be from **$0.1*I_n$ to $30*I_n$** (where I_n is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays (3 O/C element + 1 E/F element) shall have both IDMT, DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability. The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation. The numerical shall have inbuilt synchronization check (25) function.	1 set
13.	Indicating analogue ampere meter flush mounting type with dual scales option (0-900A/1800A) for connecting to the current transformer ratio 900-1800/5-5A.	3 nos.
14.	Master Trip & Trip Circuit Supervision (for each trip coil) relays.	1 Set
15.	All necessary Auxiliary & Signaling relays.	As required by BPDB.
16.	100W, 230V AC, Single Phase heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater	1 set
17.	All necessary AC DC MCB, TNC Switch, Selector Switch, Limit Switch, Control Switch, Toggle Switch, Link/ Base, Push Button, Indicating/ Illumination Lamp, AC Plug Socket, Wiring, Fuses, Hooter etc. i.e. complete in all respect. Mimic diagram with LED based Semaphore Indicator for Isolator/Breaker/Earth switch position.	As required by BPDB.

<table>
<tr><td>18.

19.</td><td>11 kV bus coupler Switchgear panel (12 window Annunciator)
<table>
<tr><td>Main DC Fail</td><td>AC Fail</td><td>Main Relay Faulty</td><td>PT Failure</td></tr>
<tr><td>TCS-1 Unhealthy</td><td>TCS-2 Unhealthy</td><td>O/C Trip</td><td>E/F Trip</td></tr>
<tr><td>Trip relay operated</td><td>Gas fault</td><td>Spring Charge Fail</td><td>SCADA/ Remote Trip</td></tr>
</table></td></tr>
<tr><td>20.</td><td>Indicating analogue voltmeter with seven position selector switch flush mounting with scales 0-15 kV for connection to potential transformer ratio (11/√3)/(0.11/√3)/(0.11/√3) kV, (50 Hz). There shall be two voltmeters, one for Bus-1 and the other for Bus-2 respectively.</td><td>1 set</td></tr>
<tr><td>21.</td><td>Capacitive Voltage Divider (CVD) based Live Line Indicator (LLI) system.</td><td>1 set</td></tr>
</table>

7.1a.4.1.4 OUT-GOING CUBICLES, EACH COMPRISING:

1.	Type of Bus Bar	HDHC Copper 2000A
2.	Bus Bar Scheme	Single Bus Bar
3.	Number of Phases	3 (Three)
4.	Operating Mechanism	For Circuit Breaker operation, both spring-operated and stored-energy mechanisms shall be available. With manual Power/ Manual, Trip Free, Electrically Spring wound operated by 240 Vac and shunt trip by 110 Vdc from storage battery, there shall be 2 Nos. Trip coils. The operating sequence OPEN-CLOSE-OPEN is stored in the springs.
5.	Rupturing Capacity	500 MVA, Symmetrical.
6.	Breaking Time	5 Cycle Maximum
7.	Continuous Current Rating	630 Amps
8.	Cable and Boxes for Incoming Cable	Suitable for size 1x3Cx185 mm^2 or 500 mm^2 11 KV XLPE cable with copper conductors.
9.	AC Control Voltage	240 ± 10% Volts
10.	DC Control Voltage	110 ± 10% Volts
11.	All Current Carrying Parts of VCB	Shall be made of Copper

12.	Single Phase Current Transformer of Ratio 200-400/5-5A of burden & accuracy class-5P20, 15 VA for protection core 0.2, 15 VA for measuring core & 0.2 (for measurement) and 20VA & 5P20 (for protection). (Characteristics: Epoxy resins insulated and double windings, butyl rubber type. The epoxy resin should be ultraviolet stabilized, fungus resistant & high tracking resistance, short time current ratings 25KA for 3 sec. & extended current ratings 120% of the rated value, secondary double winding, installation shall be in the panel)	3 Nos. (A Phase, B Phase & C Phase Shall have Individual CT)
13.	Numerical programmable Over Current and Earth fault protection relay with all necessary features for 11KV Outgoing feeder protection. The current setting range of the O/C & E/F relay shall be from **$0.1*I_n$ to $30*I_n$** (where I_n is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays (3 O/C element + 1 E/F element) shall have both IDMT, DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability. The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation	1 set
14.	Master Trip & Trip Circuit Supervision (for each trip coil) relays.	1 Set
15.	All necessary Auxiliary & Signaling relays.	As required by BPDB.
16.	Numerical Programmable 3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWH Meter of accuracy class 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, per phase & total KW with maximum demand, KVar, Power factor etc.	1 No.
17.	Indicating analogue ampere meter flush mounting type with dual scales option (0-200A/400A) for connecting to the current transformer ratio 200-400/5-5A.	3 Nos.
18.	70W, 230V AC, Single Phase heater with thermostat and a visible light indicator which indicate the "ON"-"OFF" position of the heater	1 set
19.	All necessary AC DC MCB, TNC Switch, Selector Switch, Limit Switch, Control Switch, Toggle Switch, Link/ Base, Push Button, Indicating/ Illumination Lamp, AC Plug Socket, Wiring, Fuses, Hooter etc. i.e. complete in all respect. Mimic diagram with LED based Semaphore Indicator for Isolator/Breaker/Earth switch position.	As required by BPDB.
20.	11 kV outgoing feeder panel (12 window Annunciator) **Main DC Fail** | **AC Fail** | **Main Relay Faulty** | **PT Failure**	

		TCS-1 Unhealthy	**TCS-2 Unhealthy**	**O/C Trip**	**E/F Trip**
		Trip relay operated	**Gas fault**	**Spring Charge Fail**	**SCADA/ Remote Trip**
21.	Capacitive Voltage Divider (CVD) based Live Line Indicator (LLI) system.			1 set	

***** Marking and data to be shown on the Nameplate will be as per approval.**

7.1a.4.1 BUS VOLTAGE MEASURING, EACH COMPRISING (VTs can also be incorporated in any of the GIS panel):

a) 3 nos. (for each phase) epoxy resin-insulated single phase potential transformer having a ratio of (11/√3)/0.11/√3)/0.11/√3) kV (50 Hz), accuracy class 0.2 for measurement and 3P for protection, rated burden of 20VA connected to the bus through fuses & isolator. The epoxy resin should be ultraviolet stabilized, fungus resistant and should have high tracking resistance.

b) 2 no. Indicating voltmeter, flush mounted with scale 0 to 15 KV for connection to the potential transformer.

c) 2 no. voltmeters selector switch with 7 (Seven) positions flush mounted, rated voltage 500 Volts (50 Hz) rated current 15 Amps, front plate with inscription AB-BC-AC-AN-BN-CN.

d) 1 set, necessary supporting insulators and other accessories, wiring, fuses, heater etc.

e) Selected P.T. secondary supply for metering and indicating instruments of each panel shall be fed through 4 pole MCB in each phase and link in neutral in each panel of 11KV system voltage.

f) Selected P.T. secondary supply to the protective relays of each panel shall be fed through 4 poles - MCB and link in neutral in each panel of 11KV system voltage.

g) Synchrocheck (25) function of the 11kV Bus Coupler Feeder shall be done by adjacent 2 Bus's Bus VT

7.1a.4.2 Clearances

Maximum insulator lengths and clearances in air shall be not less than those specified for 11 kV switchgear having 75 KVp Basic Impulse Level.

7.1a.4.3 Current Ratings

All parts of the switchgear, including current transformers, shall be capable of withstanding, without thermal of mechanical damage, the instantaneous peak and the three second short time current corresponding to the rated making and breaking capacity of the circuit breakers. All normal current specified are the minimum continuous values required under the service conditions appertaining to Bangladesh.

7.1a.4.4 Circuit Breaker making and Breaking capacities

Each circuit breaker shall be capable of making and breaking short circuit faults in accordance with the requirements of IEC 62271 - Circuit Breaker, at 3 phase symmetrical circuit ratings at 11 kV service voltages as stated in the Schedules.

The Contractor shall submit for approval, certified test certificates of making and breaking test carried out by approved independent testing authorities in accordance with IEC 62271.

7.1a.4.5 Circuit Breakers

7.1a.4.5.1 Type

The 11 kV circuit breakers shall be vacuum type in accordance with IEC 62271 as appropriate.

7.1a.4.5.2 Interchangeability of Circuit Breakers

Circuit breaker of the same type and current rating shall be interchangeable, both electrically and mechanically, but it must be impossible to interchange equipment of different current ratings.

7.1a.4.5.3 Circuit Breaker Operation Mechanism

Circuit breaker closing mechanisms shall be AC motor operated preferably spring operated type such that the closing speed is independent of the operator. 11kV switchgear tripping shall be effected by means of 02 nos. of 110 volt d .c. shunt trip coil. Each equipment shall be provided with a visual, mechanized, indicating device, which shall be positively driven in both directions to show whether the circuit breaker is "Open" or "Closed". Lamp indication in place of a mechanical indicator will not be accepted. Operation counters shall be provided on each mechanism.

Means shall be provided for local manual mechanical tripping of circuit breakers, preferably by push buttons, shrouded to prevent inadvertent operation.

Locking facilities shall be provided so that with the circuit breaker in any location it can be prevented from being closed when it is open and from being mechanical tripped when it is closed. This requirement shall be met by the fitting of a single padlock and shall not entail the fitting of any loose components prior to the insertion of the padlock.

It shall not be possible, without the use of tools, to gain access to the tripping toggle or any part of the mechanism which would permit defeat of the locking of the mechanical tripping feature.

It shall not be possible to render the electrical tripping feature inoperative by any mechanical locking device.

7.1a.4.5.4 Circuit Breaker Isolating Features

Irrespective of the operating type of unit the following shall apply.

Each circuit breaker shall be connected to the busbars and feeder circuit through plug and socket type motorized isolating devices (three position disconnector) with manual provision. The devices shall be of the "Off Load Type" but shall be suitable for operation whilst the busbars and/or feeder circuits are alive.

Isolating devices shall be interlocked with their respective circuit breakers to prevent their making or breaking load, but arrangements whereby attempted isolation of a closed circuit breaker trips the circuit breaker are not permitted.

The main circuit isolating devices and also all secondary circuit isolating contacts shall be of the self-aligning type, mounted in accessible positions to permit maintenance.

The number of auxiliary circuit isolating switches shall be sufficient to meet the facilities.

7.1a.4.5.5 Interlocks

All mechanical interlocks shall be of the preventive type and shall be arranged to prevent mal operation as close as possible to the point at which mechanical force is applied, in order to

prevent defeat of the interlocks by distortion of linkages Electrical interlocks shall also function so as to prevent the closing of the circuit breaker.

Interlocking between the Circuit breaker and three position switch should meet the following conditions:

a) to prevent the disconnector from switching under load, they may only be actuated with the circuit-breaker open
b) the three-position switch must be prevented from switching through from the closed state in to the "ready-to-earth" position.
c) the three-position switch can only be brought into the earthing position if the circuit breaker is open.
d) closing of the circuit-breaker must be blocked for as long as the three position switch has not reached a definite switching position.
e) for earthing of the feeder, reliable "interrogation interlocking" must be provided. Only the three-position switch is switched into the "ready-to-earth" position, feeder can be earthed and short-circuited by closing the circuit-breaker.
f) Earth switch operation shall be blocked when there is voltage in intended Line/ Bus/ Equipment.

In addition electrical interlocks may be utilized to ensure safe operation of the plant; i.e. on 11 kV transformer incoming circuits the circuit earth position shall not be operative unless the 33 kV circuit is de-energized and isolated etc.

7.1a.4.5.6 Safety Shutter Devices

A set metal shutters shall be provided to cover each 3 phase group of stationary isolating contacts.
The shutters shall open automatically by a positive drive initiated by the movement of the circuit breaker. The closing operation shall also be automatic by positive drive
When padlocked closed, the shutters shall completely shroud the stationary contacts and it shall not be possible to force the shutters or part of the shutters to gain access to the stationary contacts.

To facilitate testing, means other than locking shall be provided for securing the shutters in the open position. However, such means shall be automatically cancelled when the automatic operation of the shutters restored upon reconnection of the circuit breaker.

Bus-bar shutters shall be painted signal red, colour 537 in BS 381 C or equivalent RAL standard, and shall be clearly and indelibly labeled "BUSBARS" in large white letter in English. The contractor may offer works which comply with different standards or codes only if, when requested by the Engineer Circuit shutters shall be painted yellow, colour 355 in BS381 C or equivalent RAL standard, but shall not be lettered, except that on incoming feeders the circuit shutters shall be clearly and indelibly labeled "DANGER LIVE CABLES" in large red letters.

Voltage transformer spout shutters shall be painted yellow, colour 355 in BS 381 C or equivalent RAL standard. Durable phase colour identification shall be provided in a prominent position. Provision or access shall be made for lubricating the mechanical linkages.

All shutters shall be effectively earthed

Shutters shall not operate towards the fixed isolating contacts.

7.1a.4.5.7 Busbars and Connections

The equipment shall be of single busbar type. Busbars and connection shall comply with applicable clauses of IEC 62271 and shall be fully insulated.

The equipment shall be of single busbar type. The busbar assemblies shall be of a type which shall not rely only on air for insulation purpose.

Any earthed screen applied to the exterior of the insulation shall be securely earthed in each busbar compartments.

The insulation of the busbars and their connections shall be capable of withstanding, without damage, the thermal and mechanical effect of a through fault current equivalent to the short-time rating of the switchgear.

Access to busbars and the connections directly thereto shall be gained only by the removal of covers secured by bolts or screws. Such covers shall be marked clearly and indelibly "BUSBARS"

Busbars shall extensible at both ends; such extension shall entail the minimum possible disturbance to the busbar chambers. Compound filled busbar chambers are not acceptable.

7.1a.4.5.8 Earthing of Metal Parts of Switchgear

All metal parts, other than those forming part of an electrical circuit, shall be connected to a hard-drawn, high conductivity, copper earth conductor on each unit, of adequate sectional area.

Interlocking (both mechanical & electrical) must be provided to avoid accidental earthing circuit breaker in "service position".

7.1a.4.5.9 Earthing of Insulations

Earthing of the switchgear and ancillary panels and auxiliary equipment shall be carried out in accordance with IEC 62271 Standard where applicable.

7.1a.4.5.10 Insulators

Porcelain insulators shall be best quality electrical porcelain. The clamping surfaces of all porcelain insulators shall be accurately ground and shall be free of glaze.
Insulators of moulded or resin bonded material shall have a durable, non-hygroscopic surface finish having a high anti-tracking index.

7.1a.4.5.11 Auxiliary switch

Each circuit breaker shall be provided with adequate nos. auxiliary switches to interrupt the supply to the closing mechanism and to complete the trip circuit, when the circuit breaker is in the "Closed" position and to cover all the necessary indication, interlocking and control facilities with spare contacts.

Each circuit breaker shall be provided with clean auxiliary contacts for the purpose of providing remote switch and alarm indication at the remote grid supervisory centre. In addition each circuit breaker shall be provided with the necessary 50 volt d.c. Interposing relays required to achieve remote control of the circuit breaker via a future remote grid supervisory system. All auxiliary switches shall be wired down whether in use or not to the appropriate marshaling kiosk.

7.1a.4.6 Special Tools

One complete set, of all special tools that are necessary for the overhauling maintenance and adjustment of the whole equipment shall be provided with each switchboard. The tools provided shall be in a new condition and shall not be used for the erection of the equipment on Site.

7.1a.4.7 Indoor Breaker Specification

The 11 kV switchgear unit indoor vacuum CB along with CT, 11 kV bus, 11 kV PT (3 × single phase unit – draw out/ plug in type). The C.B shall have spring operating mechanism suitable for charging by motor (universal type) with provision of hand charging. Sufficient auxiliary contacts shall be provided for position indication, interlocks and other purposes. Two sets of independently operative trip coils shall be there. Provision for signaling of low gas pressure and ultimate lock out for very low pressure shall be provided.

Technical Particulars of 11 kV Circuit Breakers:

Phase	3-phase Service
Voltage/Maximum system Voltage	11kV/12 kV
Continuous rating current of Bus-bar	2500 Amps.
Continuous rating current	2500 A for Incomer 2500 A-for Bus Coupler, 630A for 11KV Outgoing feeder
Breaking Capacity	25 KA (3 Sec).
Basic Impulse Level (BIL)	70 kV,
Power frequency withstand voltage	28 kV.

Bus Shall be 3 phase, 50Hz 2500 A, air insulated capable of withstanding **25**kA for 3sec.

2)

3) **7.1A.4.8 PROTECTIVE RELAYS**

All Protective relays shall be numerical programmable type and shall comply relevant IEC or equivalent international standard. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station.

All the protective relays shall be supplied from any of following manufacturers:-

a) ABB (Switzerland/Sweden/Finland).
b) Siemens (Germany).
c) ALSTOM (UK/France)
d) Schneider Electric (UK/France)
e) NR, China
f) SEL, USA

****** 11 kV Bus Coupler Feeder panels Numerical Relay should have synchronization (25) function.**

Note: Supply of Related software with required license keys & accessories is within the scope of supply.

7.1A.4.9 ENERGY METERS

KWH meter shall 3-phase 4-wire, Numerical Programmable Multifunction KWH Meter of accuracy class 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with maximum demand, KVAR, Power factor etc.
It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850. However, the detail specification of the meter shall be same as that for 33 kV PCM panel meter described in **clause 7.1.3.24.**

All the energy meter shall be supplied from any of the following manufacturers:-

a) Siemens, Germany/Switzerland.
b) AEG, Germany.
c) ABB, Switzerland/Finland
d) Itron, USA
e) Elster, USA./Romania
f) Landis+ Gyr, Switzerland
g) Toshiba (Japan)
h) Honeywell (USA)
i) CEWE, UK

Note: Manufacturer's authorization for Protective Relays & Energy Meters (KWh) shall furnish with the offer. Necessary software & accessories is within the scope of supply.

7.1a.4.10 Current Transformers (CTs).

The current transformer rated current ratio shall match the connected load circuit and secondary circuit requirements.

Current transformers shall be capable of withstanding without damage the full load, peak and rated short time currents of their associated equipment.

Where space within a current transformer chamber permits dedicated current transformers shall be used for protection, instrumentation and metering.

Current transformers used for energizing indicating instruments and metering shall be of Class 0.2 accuracy in accordance with IEC 600441. Current transformers for protective and protective/indication purposes shall be designed to suit the particular requirements of the

associated protection, which in general shall be in accordance with the recommendations given in BS 3938 or equivalent IEC standard.

Class 5P current transformers shall be used for inverse time over-current and/or earth fault protection. The rated accuracy limit current shall be equivalent to the maximum symmetrical three phase fault current or earth fault current of the protected circuit or equivalent tot he switchgear breaking capacity unless otherwise approved by the Engineer. The current transformers shall be capable of meeting the 5P error classification at rated accuracy limit current over the full range of relay settings, unless otherwise approved by the Engineer.

Current transformers used for indication/metering purposes shall be designed to saturate at a value of primary current sufficiently low to protect the secondary circuit from damage at all possible values of primary fault current up to the associated primary short time thermal rating.

The rated volt-amp output of each current transformer shall not be less than 110% of the connected burden as installed in service, the burden of cable connections being taken into account

The secondary windings of each set of current transformers shall be earthed at one point only via an accessible bolted disconnecting link, preferably located within the relay cubicle.

Where double-ratio secondary windings are specified provided a label shall be provided at the secondary terminals of the current transformer indicating clearly the connections required for either tap. The connections and the ratio in use shall be indicated on all connection diagrams.

Design magnetization curves and d.c resistance values shall be submitted before manufacture for each current transformer used for protective purposes and shall be subsequently verified by works routine tests and also by site commissioning tests.

Where current transformers have to operate or be mounted on apparatus provided under other contracts, the Contractor shall be responsible for ensuring design and installation compatibility with other Contractors and for keeping the Engineer informed.

Metal clad switchgear current transformers shall be located on the non-bus-bar side of the circuit breaker except where current transformers are provided on both sides of the circuit breaker for protection zone overlap. The primary conductors shall be accessible for primary current injection treating on site.

7.1a.4.11 Voltage Transformers (VTs)

Voltage transformers shall comply with the requirements of IEC 60044-2 with amendments and supplements and shall be of:-

- Class 3P accuracy for protection/indicating instruments
- Class 0.2 accuracy for tariff metering or acceptance efficiency testing.

For tariff metering voltage transformers the Contractor shall check the total installed secondary burden and if necessary shall install dummy burdens to achieve the calibrated accuracy.

Voltage transformer secondary circuit shall be earthed at one point only and metal cases shall be separately earthed. The transformers core, where accessible, shall also be separately earthed. All voltage transformers in the system at a given voltage level shall be earthed in the same manner.

Where it is required to earth the primary neutral of a metal clad three- phase voltage transformer, the neutral earthing connection shall be insulated and brought out separately from the tank earthing connection. Means shall be provided to maintain the tank earthing connection while the voltage transformer is being withdrawn.

Where three single-phase voltage transformers are supplied for protection purposes, star connected secondary windings shall have the star point formed by insulated connections and shall be earthed at a common point.

Where possible primary windings shall be connected through fuses with current limiting features. All the 11kV Bus VTs shall be draw out/plug-in type installation with manual isolating switch.

Secondary MCB's shall be provided as close as possible to each voltage transformer and labeled to show their function and phase colour. The secondary circuits shall be monitored individually to detect and alarm individual fuse failure or MCB trip and to block protection operation if required.

Voltage transformers shall be designed that saturation of their cores does not occur when 1.732 times normal voltage is applied to each winding. Magnetization curves shall be submitted for approval for each type of voltage transformer.

The standard secondary voltage between phases shall be 110 volts unless special circumstances dictate otherwise, and are approved by the Engineer.

Secondary circuits from different voltage transformers, or separate windings of the same transformer, shall not be connected in parallel.

Voltage transformers shall be connected on the non-busbar side of circuit breakers unless otherwise approved by the Engineer.

7.1a.4.12 FEATURES & ACCESSORIES

a) VCB should be restrike free.
b) VCB should be trip free.
c) Vacuum Interrupter shall be capable of short circuit current switching ≥ 50.
d) Breaker trucks of different current ratings shall not be interchangeable. The breaker truck shall be wheel mounted and rail supported.
e) All current carrying parts shall be made of copper.
f) Hand closing and tripping shall be done through manual levers.
g) Manually operating devices for slow closing for inspection and maintenance. It shall not be possible to slow close a breaker when in normal services.

h) Each cubicle shall have ON-OFF indicator and provision for manual operation and necessary mechanical & electrical interlocking.

i) Protective relay shall be sufficient for over current and earth fault protection and shall be of numerical programmable type. Accessories/Software required if any, Control & Protection Scheme drawings and Operation & Maintenance manual is within the scope of supply for each panel. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station. In addition, numerical relay shall have sufficient contacts and shall be configured for SAS operation. Intermediate auxiliary relay with sufficient spare contacts shall be used for controlling CB or any other switching devices through numerical relay in case of SAS operation.

j) All indicating meters will be semi flush type with full view 240" scale range with intimate dial, black marketing and pointer with moving element with zero adjuster.

k) The painting shall be gray (RAL 7032) outside and glazed white inside.

l) All equipment and accessories shall be fully tropicalized.

m) Necessary foundation bolts, spare heaters (installed and wire), manual handle for the breakers, test jumpers, portable lamp, set of test plug for test terminals and draw-out type relay shall be supplied.

n) The complete panel and its accessories shall be made to the latest relevant IEC standards.

p) Rating plate and diagram plate having all information as per relevant IEC standard shall be made of stainless steel and have engraved letters filled with black enamel paint.

q) At least three sets relay & meter testing plug shall be supplied.

r) Each VCB cubicles shall be complete according to the specification, features and bill of materials but not limited to these items; the VCB cubicles should be complete in all respects, to make it fully operational.

s) Tripping from protection to circuit breakers shall be through fast acting (<10 msec) Trip relays.

t) CT terminal block shall have isolation, shorting & jacking facility while PT terminal block shall have isolation & jacking facility.

u) Sufficient spare terminals (at least 10%) in each terminal block.

v) Provision to hang danger/ caution board.

w) The Switchgear panel shall be SCADA/SAS compatible and hence all intelligent devices, digital energy meters etc. shall comply IEC61850. All physical connections for control, measurement and status indication shall be made SAS ready.

x) 70W, 230V AC, 1-phase heater with thermostat and control switch and a visible light indicator which indicate the “ON” & “OFF” position of the heater.

y) Electrical push button/TNC switch for Circuit breaker & Three position switch (Disconnector-Earth switch) Open-Close operation in the panel’s front side for easy access. Circuit breaker’s emergency mechanical OFF push button shall be free from any mechanical & electrical interlocks except permanent feeder earthed & locked scheme.

z) Circuit Breaker shall have 2 trip coils, Both trip coils shall be energized by separate contacts of master trip relay for protection tripping. However, for manual tripping, only one trip coil can be engaged only.

aa) Indicating/Signaling Yellow Lamps shall be of LED type for Heater on indication.

ab) Mimic diagram shall contain LED based Semaphore Indicator instead of moving Semaphore indicator.

ac) Ferrule marking and color coding for all type of wiring shall be as follows:

1. **Ferrule marking:** Ferrule marking shall be done by white flexible rubber/ PVC tube with permanent black ink printing on top, fitted with cable, double point addressing (source-destination)
   i. "A"- for differential protection circuit
   ii. "C"- for O/C & E/F protection circuit
   iii. "D"- for metering circuit
   iv. "E"- for PT circuit
   v. "L"- for Alarm & Indication circuit
   vi. "S"- for fault recorder
2. **Color coding:**
   i. "Black"- for phases of AC supply
   ii. "White"- for neutral of AC supply
   iii. "Grey"- for control circuit
   iv. "Brown & Grey"- for (+) and (-) DC supply respectively
   v. "Red, Yellow, Blue, Black"- for CT and PT circuit
   vi. "Yellow with green strip"- for earthing

ad) A copy of Control circuit scheme shall be laminated and fixed to the inner side of the door of the cubicle

ae) Operation Counter for the circuit breaker.

af) Anti pumping feature shall be provided/ included.

ag) Bidder shall supply related software (1copy) and manuals describing trouble shooting procedure(3copies).

ah) Bidder shall supply the operation manuals of relay and meters describing the trouble shooting and configuration procedure (3copies).

ai) Inter tripping arrangement for 11 kV incomer Cubicle (from 33 kV transformer feeder tripping) and for 33 kV transformer feeder (from directional tripping of 11 kV incomer or Stand by E/F tripping) shall be provided.. Necessary SAS signaling shall be integrated.

aj) Separate MCBs shall be provided for DC supply to Power, Control and Alarm & Indication circuits.

ak) All type of tripping shall be done through Master Trip relay.

al) Alarm signal for CB operating spring charge fail shall be given using settable time delay relay (time needed for charging the spring) and this alarm signal shall be incorporated in the annunciator & SAS.

am) The annunciator shall have provision for operating on both 110VDC & 240VAC, single supply at a time (auto supply changeover), mainly 110VDC operated and should generate alarm for any of the supply fail. Also Annunciator shall have built-in mute & acknowledge option accessible via SAS command along with other necessary features (built in buzzer/hooter with accept, reset, mute & test push buttons).

7.1A.4.13 TRIP RELAYS

Following shall be the main features of a high speed tripping relays:

All tripping relays shall be of the heavy duty and self-reset type suitable for panel mounting and shall have operating coils which are rated sufficiently to operate in conjunction with series flag relays. If necessary, normally closed contacts in series with the relay operating coil, shall be delayed for a period which will allow series flag relays to operate satisfactorily. All other tripping contacts should be instantaneous i.e. no intentional time delay. The operating time shall not exceed 10 milliseconds at rated voltage. The operating range of the relay shall be from 70% to 120% of rated voltage.

Trip Relay shall be of following types:

a. Self-reset type (for over current & earth fault protection numerical relay)
b. Operating Coil Voltage: 110 V DC (No series resistor allowed.
c. Shall have in built freewheeling diode.

Wherever the tripping relay contacts need to break the D.C., sufficiently rated magnetic blow out contacts or such approved means shall be used.

4) 7.1A.4.14 INDICATING AMMETERS

Each 11kV PCM Cubicle will be provided with 3 Ammeters, analogue type/Digital Multifunction Meter (1 for each phase).

5)

6) 7.1A.4.15 INDICATING VOLTMETERS

1 (one) voltmeter with selector switch, analogue type /Digital Multifunction Meter with a multi-selector switch (phase to phase, phase to neutral, off) shall be installed.

7.1A.4.16 EARTHING SYSTEM

Earthing of metallic parts or metallic bodies of the equipment on the Panel shall be done with soft drawn single conductor bare Copper Tail connections shall have minimum area of 16 sq, mm. and

the main earthing connection 60 sq.mm. These wires shall be connected by suitable terminals and clamps junction. Soldered connections shall not be employed.

All metal parts other than those forming part of any electrical circuit shall be earthed to the earthing system. Any necessary terminals on any part of the equipment required for this purpose shall be provided by the Manufacturer. Earthing conductor cross section shall be in accordance with the manufacturer standards which shall be proved with necessary type test reports. However, for 33kV switchgear minimum 300 mm^2 cross section copper bar shall be employed for earthing. The copper earth bar shall run along the full length of the switchboard and earthing studs shall be provided at not less than two points. The frame of the draw-out circuit breaker earthing truck shall be automatically connected to the switchgears bar through substantial plug type contact when the circuit breaker is in disconnection, service and test position.

7.1A.4.17 SUPERVISION RELAYS

7.1A.4.17.1 Trip Circuit and Protection Supply Supervision

The trip circuit supervision function shall be a separate relay and independent of control and protection unit provided in the switchgear. Trip circuit supervision relays shall be provided to monitor each of the trip circuits of all 11kV circuit breakers and each relay shall have sufficient contacts for visual/audible alarm and indication purposes. The trip circuit supervision scheme shall provide continuous supervision of the trip circuits of the circuit breaker in either the open or closed position and independent of local or remote selection at the local operating position. Relay elements shall be delayed on drop-off to prevent false alarms during faults on dc wiring on adjacent circuits, or due to operation of a trip relay contact. Series resistances shall be provided in trip supervision circuits to prevent mal tripping a circuit breaker if a relay element is short circuited. Relay alarm elements shall be equipped with hand resetting flag indicators.

Trip circuit supervision relay (TCSR) shall supervise not only the trip coil but also the whole trip circuit during both breaker open and close position (pre-close & post-close). Both trip circuits shall be supervised by separate TCS relay. TCS function of main relay shall be avoided for supervision.

All the TCS relay shall have at least 3NO+3NC contact for Indication, Annunciation & SAS Integration. 2 NO contact shall be used for CB closing circuit interlock & closing readiness indication (if used) and 2 NC contact shall be used for TCS faulty Annunciation & SAS integration.

7.1A.4.17.2 D.C. Supply Supervision

All the DC Supply MCB (Main supply, Control supply, Device supply, Indication supply, Annunciation supply etc.) shall have at least 2NO+2NC contact for & there shall be 1 (one) 110V D.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main DC supply entry point at terminal block with inscription "Main D.C. Supply Supervision relay" and shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration. These supervision relays are to be independent of alarms from the trip circuit supervision scheme so that the operator can clearly differentiate via the available alarms between loss of supply due to a blown fuse / tripped MCB and failure of a trip circuit's supervision /faulty supervision wiring. 1 NO contact of the Main DC supply supervision relay & DC supply MCBs shall be used for DC supply healthy indication (if used) and 2 NC contact shall be used for DC supply faulty Annunciation & SAS integration.

DC supply supervision of the annunciation circuit shall be performed by the built in AC/DC fail relay of the Annunciator. Hence, the Annunciator shall be powered by dual source (with internal/external AC/DC changeover switch).

7.1A.4.17.3 PT Supply Supervision

Each PT supply secondary circuit shall be supervised by individual 110V A.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main PT supply entry point at terminal block with inscription "Measuring/Protection P.T. Supply Supervision relay" with at least 2NO+2NC contact for Indication, Annunciation & SAS integration. As per section 7.1a.4.1, 1 NO contact of the PT supply supervision relay & PT supply MCBs shall be used for PT supply healthy indication (if used) and 2 NC contact shall be used for PT supply faulty Annunciation & SAS integration.

7.1A.4.17.4 A.C. Supply Supervision

There shall be 1 (one) 240V A.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main AC supply entry point at terminal block with inscription "Main A.C. Supply Supervision relay" and shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration.
All the AC Supply MCBs (Main supply, Spring charge motor supply, TPS motor supply, lighting & heating supply etc.) shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration. 1 NO contact of the Main AC supply supervision relay & AC supply MCBs shall be used for AC supply healthy indication (if used) and 2 NC contact shall be used for AC supply faulty Annunciation & SAS integration.

7.1A.4.18 MIMIC BUS

Mimic bus material shall be brass, bronze or copper with enamel finished or anodized aluminum or plastic. The mimic bus and included symbols shall be shaped, colored and located as international standard. Light indicator showing position (opening/closing) of circuit breaker, DS, ES shall be installed.
The mimic bus shall be attached to the panel by mechanical devices, not with adhesive. Attachment shall be closely spaced to hold all parts of the mimic bus firmly to the panel face.
Mimic bus shall be provided with the following dimensions and color code:-

Voltage	Bus Color	Thick	Dimension (mm)
11 KV	Black	3	12

LED based Semaphore Indicator showing the position (open/close) of Circuit Breaker and Earth Switch shall be inserted within the mimic bus.

7.1a.4.19 Auxiliary Relays

Each 11 kV Switchgear Cubicle shall be provided with 1 (one) set separate Auxiliary and signaling relay and wiring with fuses. This relay shall be used for control & monitoring of CB and ES through numerical relay/BCU in case of SAS operation.

7.1a.4.20 Live Line Indicator

Each 11 kV Switchgear Cubicle shall be equipped with CVD based Live Line Indicator (LLI) system.

7.1a.4.21 Information Required

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides

these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components (i.e. breakers, vacuum interrupter, relays, energy meters, annunciator, etc.) of offered type equipment.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.
d) Manufacturer's ISO 9001 Certificate.

7.1a.4.22 APPROVAL OF DRAWINGS

The successful bidder/tenderer shall submit the following drawings in AutoCAD format and in hard copy for the approval to the Engineer, Director, Design & Inspection–II, BPDB within within 15 days from the date of signing Contract.

1. Technical Specification and Guaranteed Technical
2. Detailed dimensional drawings of 11KV Switchgear including foundation drawing. with cable slots showing all equipment mounted on them along with complete panel wise list of equipment and list of Name Plates. Weight of these panels with all the equipment mounted on these shall also be furnished in the Drawing.
3. Outlined drawings of internal wiring diagram of the instrument, relays, meters, annunciator and other equipment showing external terminal connections with the equipment terminal number.
4. Complete AC and DC Schematic diagram of 11 KV Switchgear Panels to indicate the followings:
   i) Annunciator circuit
   ii) Protection and control circuit
   iii) Indication and Supervision circuit
   iv) Other circuits as necessary
   These drawings shall show AC power connection and Secondary connections for relays, meters, terminal blocks with their number etc. interconnection diagram between PCM and circuit breaker, Power and Instrument Transformer and other equipment as necessary
5. Cabling and wiring diagram of the cubicles and inter-connections between them. Ferrule numbers, device number and grouping for cable take off shall be distinctly shown. No work shall be performed in connection with the fabrication and manufacture of the testing equipment until the technical data and drawings have been approved.
6. Manufacturer's printed catalogue describing the type/model of offered 11KV Switchgear, Protective relays, Energy Meters
7. The Bidder shall have to submit 3 (three) sets of the same for Approval. The bidder shall also submit one set reproducible tracing of the above drawings in soft format.
8. List of switchgears electrical & mechanical interlock, BCPU/Relay's BI, BO, LED, Annunciators window and related drawings shall be submitted with detail switchgear drawing during approval stage.

No work shall be performed in connection with the fabrication and manufacture of the Testing Equipment until the technical data and drawings have been approved. The manufacturing of

the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. The cost of supplying drawings and specifications shall be borne by the supplier.

At the time of delivery of Equipment, the supplier shall supply three (3) sets of all approved technical data and drawings in bound book form along with manufacturer's original catalogue of the Equipment to the office of Director, Design & Inspection-II, BPDB, 9/B, Motijheel C/A, Dhaka, Bangladesh, Telephone # 88-02-9550404

7.1A.5 SPECIFICATION OF 110V, 3 x 5(6) A, 3-PHASE, 4-WIRE, 3-ELEMENT, INDOOR TYPE MULTI-TARIFF PROGRAMMABLE METER WITH ASSOCIATED INSTRUMENT TRANSFORMERS ENCLOSED IN METERING PANEL.

7.1A.5A GENERAL

The meters are required for the purpose of energy metering of medium/high/extra-high voltage consumer metering at 132 kV or 33 kV or 11kV level . KWh is the unit for the purpose.

System voltage	Nominal service voltage 110V (PT Secondary), 3 phase 4wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	50 Hz

7.1a.5.B SPECIFICATION OF 110V 3 x 5(6)A, 3-PHASE, 4-WIRE 3-ELEMENT, INDOOR TYPE MULTI TARIFF PROGRAMMABLE DIGITAL ENERGY METER

The consumer meters are required for the purpose of energy metering of low voltage consumer who purchases power at 11 kV/33 kV line through PT & CT. kWh is the unit for revenue purpose.

System voltage	:	Nominal service voltage 110V, 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	:	50 Hz
Standard	:	The Energy Meter should be designed, manufactured and tested in accordance with IEC 62052-11, 62053-22 and 62053-23 or ANSI C 12.16, 12.10 (latest publication) or specified in this specification
Installation	:	Indoor Type
Type	:	Solid state.
Application	:	Registration of KWh (Peak & off-peak), Total KVarh(Q1+Q4), KW on 3- phase, 4-wire supply for balanced & unbalanced load (unidirectional). Peak 17.00-23.00. hrs and off peak 23.00-17.00 hrs (programmable) Bangladesh standard time. The software for Time of Use (TOU) shall be so developed to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
Connection	:	3-phase 4-wire, solidly grounded neutral.
Nos. of element	:	3 (Three)
Rated current	:	Basic current 5 amps and maximum current ≥6 amps.

Multiplication factor : The following shall be inscribe on the mater. Dial reading X CT ratio X PT ratio = Actual reading in KWh.

Register : Solid state LCD display type register. The display shall be programmable, automatic and include:

- Meter ID
- Time & date
- Cumulative KWh (Peak & off-peak)
- Cumulative Total KVarh (Q1+Q4)
- Maximum demand (KW) with time & date
- Cumulative Maximum demand (kW) for billing month.

Maximum demand (MD) in kW shall be registered using the technique of cumulating on integration period controlled by built-in process and the MD shall be continuously recorded and the highest shall be indicated. The highest MD shall be added to the cumulative store, which shall be automatically initiated after an interval of one month / one billing period by means of built-in timing device.

- Integration period: 30 (thirty) minutes.
- Number of MD reset (Automatic& manually).
- Average PF for billing period.

Instantaneous:

- Phase voltage with indication
- Phase amps with direction.
- Power factor (average).
- Demand (KW)
- Voltage phase angel (each phase) | or P.F. Angle(each phase)
- Current phase angle(each phase)
- Tampering indication in the register.

Memory storage : The meter shall have sufficient capacity (minimum 400 KB) to store the following readings and data in non-volatile memory even in case of power failure.

- Equipment identification codes, security codes and access codes.
- Number of power interruption with date & time (minimum 100 events).
- Latest power failure time & date
- Date & time of meter tempering. (Voltage & Current missing, demand reset , time change).
- Event logs
- Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4)
- Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence.

		The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 90 (ninety) days. • Load Profile data [kWh, KVarh (Q1+Q4) • Phase voltage or Vh • Phase amps or Ah
Accuracy class	:	Accuracy class is 0.2s (point two s)
Number of digit		Minimum 5 (Five) integer with 1 (One) decimal (Total 6 digit).
Type of Display		Solid-state LCD display.
Time switch	:	The time switch shall be built-in type and shall be designed to perform a present cycle of operation. Time switch shall reset MDI at the end of every month (billing period) automatically. In the event of failure of power supply and battery, at the same time set memory shall not be lost i.e. the set program shall be recorded in non-volatile memory. The maximum error shall be kept within ± 1 (one) second per day. Time error adjustment facility shall be provided.
Battery reserve	:	Each time switch must be provided with lithium battery which allow the switch to function for a period of not less than 10 (ten) years. The guaranteed life of the battery should not be less than 10 (ten) years and shall have provision for easy replacement. The shelf life of the battery should be minimum 15(fifteen) years or more.
Construction	:	The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic /phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to accommodate both padlock and wire type seal. IEC meters shall be minimum IP51. The ANSI Standard meter shall be effectively sealed to prevent entrance of rain and dust into its internal parts. The meter shall pass Rain test described in underwriter's laboratory standard UL-50 (USA) for type 3 enclosures. A general purpose finish of class 1 as specified in section 7 of ANSI C12.10 shall be provided for the meter and it shall meet the requirement of weather simulation test (Sec. 7.2.1 of ANSI C12.10) and salt spray test (ASTM B117). It shall be designed to operate continuously for the normal life of the meter in unsheltered outdoor tropical location exposed to the elements without corrosion or other damage to parts to adversely affect meter accuracy or reliability.
Enclosure for IEC Standard Meter		The meter shall be surface mounted in an outdoor pole mounted metering enclosure box with necessary wiring. The enclosure box

should be made either of high quality flame retardant ABS Resin of minimum 3 mm thickness or of galvanized sheet steel of minimum 1.22 mm (18 SWG) thickness or of auto extinguishable, shockproof and UV resistant, hot molded glass reinforced polyester of minimum 3 mm thickness. The box shall have hinged front door with one toughened glass window or transparent UV resistant Polly carbonate to enable easy reading of meter. The metering box shall be weather proof, dust proof, rodent and inspect proof in accordance with enclosure classification IP54. Service cable entry and exit will be sides of the box and 40 (forty) mm diameter hole with black PVC conic cable gland shall be provided for side entry & exit for this purpose. All material parts shall have anti-corrosive protection.

All materials shall be designed, manufactured and tested as per IEC or equivalent International standards except as mentioned. The front door shall be removable and provision must be made for sealing in the closed position.

Socket	:	Meter sockets shall be suitable for installation of offered type meter. Meter sockets shall be 3-phase, 4-wire wye, 600 volt class, made from 16 gauge sheet metal. Meter sockets shall be similar except as described below. Meter sockets shall approximately 14″ (35.6 cm) H×9″(22.9cm) W×4″ (10.2 cm) D and rectangular in shape. Sockets shall be the same size as 1-phase sockets and terminal blocks shall be interchangeable. Sockets shall be ring less type, sealing latch to be stainless steel and have adequate means for socket grounding. Meter socket shall have a 2″(5 cm) Diameter top opening complete with a 1- ¼″ (3.2 cm) hub. Meter socket shall have 4 knockouts with a range up to 2″(5 cm) Diameter, one on the back, one in the bottom and one in each side. Meter socket shall comply with ANSI C 12.6, 12.10 The Socket shall have written permanently (not in paper printed) “connection diagram” distinctly marked in addition to all standard data.
Terminal	:	Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.
Connection	:	3-phase, 4-wire solidly grounded neutral.
Service life of meter	:	Shall be minimum 15 (fifteen) years.
Visual indication of operation	:	Pulse indicator on the front of meter as per meter constant.

Special condition	:	a) The factory calibration conforms to relevant IEC or equivalent international standard. LCD display shall be shown consecutively and continuously one after another. The display shall be automated i.e. no external means shall be required to see the display. Each display shall last for at least 5 (five) sec. b) Meter Electronic Circuit biasing voltage shall have to be ensured from each phase to phase and each phase to neutral and minimum basing voltage 40V.
Meter Sealing	:	The Energy meter body will be hermetically sealed or ultrasonically welded to avoid unauthorized opening of meter cover. Otherwise the bid will be rejected.
Communication port	:	The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard.
Remote Communication	:	The meter shall be equipped with external GSM-GPRS Modem, which will be able to interface with RS232, RS485 for data communication with the central server from meters, having all accessories like power supply adapter, necessary connecting cables, antenna with minimum 2.5 meter extension cable, connectors, enclosure box with fixing materials etc. The modem shall be compatible with existing AMR system of BPDB.

7.1a.5.C. TAMPER AND FRAUD PROTECTION FEATURE:

The meter shall have the following features to prevent/detect tamper and fraud:

- **Phase Sequence Reversal:** The meter should work accurately irrespective of phase sequence of supply.
- **Missing Potentials:** The meter shall be capable of detection occurrence of missing potential of one phase or two phase(s), which can happen due to intentional/accidental disconnection of potential link(s).
- **Terminal cover** must have micro-switch provision to monitor unauthorized opening. Opening of terminal cover shall trigger an event to be recorded in the event log memory.
- **Software Access:** Software access for configuration and setting of the meters.

7.1a.5.D TECHNICAL FEATURE

- The body cover and socket / enclosure shall be provided security sealing provisions to prevent unauthorized access to the internal meter works.
- The meter shall be provided with connection diagram.
- The data access should be protected by minimum 3(three) steps software password in meter.
- The meter shall have provision of phase to phase and each phase to neutral biasing.
- The meter shall have minimum biasing voltage of 40V otherwise the bid will be rejected.

- The meter and socket/enclosure shall have provision of earthing.
- Meter must operate and accurately register demand and energy when service voltage is applied across any two of the three input terminals or when service voltage is applied from any input terminal to neutral. Meter will continue to operate even the neutral is missing.
- The meter and socket/ enclosure must be the same country of origin other wise the bid will be rejected.
- The registration of KWh (Peak & off-peak) on 3-phase, 4-wire supply for balanced & unbalanced load will be unidirectional. i.e. if one, two or three phase supply is/are reversed, it will take the absolute (kWh-del) + absolute (kWh-rev) and will add them together as total 3-phase KWh.
- The meter shall be equipped with remote GSM & PSTN communication option.
- It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850
- The meter shall have permanently print nameplate distinctly marked with the following in addition to all standard data:
    1. The word "BPDB" and insignia of BPDB.
    2. Voltage and current rating.
    3. Frequency.
    4. Number of element, number of wire and multiplication factor.
    5. Accuracy class.
    6. Year of manufacture.
    7. Serial number.
    8. Name of manufacturer.
    9. Meter constant.

7.1a.5.E. Display of measured values/ Meter Display

- The Sequence of LCD display should be user programmable.
- The contrast setting of LCD display should be visible in different lighting environment and distinctly visible in broad daylight.
- The meter should be of displaying time and date, the direction of energy i.e. as import/export or +/-, active tariff and internal fault indicators.
- There should be up to three groups of display to priorities the display. Each showing a programmable function group.

7.1a.5.F Meter Parameterisation Software

- The parameterisation software must run on Windows operating environment.
- The software must be protected by software keys to control duplication and installation.
- The software should have a customizable printing feature by task list.
- The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase

(voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 8(eight) Channels data stored in different interval for 90 days.

- Tamper feature: The meter must have Errors & Warnings codes, History log and Event log(minimum 400events) to record date & time of all power outages, demand resets, time change.
- In addition, each software key must bear a unique user ID and that is not transferable to another PC that has different user ID.
- The Meter should be able to display the phasor diagram.
- The software for Time of Use (TOU) shall be compatible to accommodate future tariff and can be customized, if the purchaser changes the tariff .The software shall be compatible with Windows operating system.
- The Meter must be provided with meter passwords to secure communication between meter software and meter having minimum 3(three) access levels.
- The AMR Software have to be compatible with BPDB's existing AMR System. The Tenderer have to develop the total AMR System with exiting and supplied AMR Solution. In this case the tenderer have to provide their meter protocols so that all exiting meters and supplied meters data will be downloaded and managed in a single AMR System.

7.1a.5.F2 EXTERNAL MODEM WITH ACCESSORIES

GSM/GPRS modem with RS-232 ports, meter interfaced power supply, connection cables, antenna with minimum 2.5 meters cable, mounting facilities, enclosure (if necessary). The modems will be capable of GSM and GPRS connectivity simultaneously. For GSm configuration the AT command will be available and for GPRS communication the APN, reset time, username, password, port number, etc. are configurable. The modem will have the following specification.

Interruption (< 1 ms), RS-232 (at least 1), GPRS class 10, operating band 900/1800, auto reset capability (with phone call, SMS). The modem will be robust, durable and compatible with the employers existing service condition.

7.1a.5.F3 Manufacturer

All the energy meter shall be supplied from any of the following Country: -

a) European Country.
b) North American Country.
c) Japan
d) Australia

The tenderer should submit authentic document with the tender against the country and location of the offered Electric Energy Meter Manufacturing plant which will be verified during tender evaluation.

Note: Related software & accessories if required for Energy meters is within the scope of supply.

7.1a.6 Technical Orientation and Quality Test Witness (Acceptance test) for 11kV GIS:

A. FACRORY INSPECTION AND TEST WITNESS:

Witnessing of the manufacturing process and tests of the equipment at manufacturer's premises including transfer of technical know-how shall be required/held as detailed elsewhere in Particular Conditions of Contract (GCC 32.1) of tender document and other than this the following will be as follows:

The BPDB's inspection team proposed by the purchaser or consignee (if consignee is Project Director) and approved by the competent authority shall have the right to inspect, examine and test the workmanship and performance of the goods/materials to confirm the conformity to the specification at all reasonable time before and during manufacture at the manufacturer's premises.

The manufacturer will allow inspection team to inspect the manufacturing process and quality control and progress of the work at any time need by BPDB's inspection team. This team will witness the Factory/Technical orientation & Quality test at the manufacturer's plant. The Manufacturer shall have facilities to carry out all tests at its premises and shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently.

The inspection team maximum 2 (two) times may inspect (if required) the goods during the manufacturing process or after manufacture of Goods as required and shall also request to supplier for the purchase/ import/ shipping documents of major/key materials of Goods and shall check in accordance with Guaranteed Technical Particulars (GTP) and guarantees of the contract. All expenses for such tests shall be borne by the supplier.

BPDB's Inspection Team will witness the routine test at the manufacturer's premises. Tests shall be performed in accordance with the relevant IEC/BS/ANSI/ASTM/BDS standards or any other standard mentioned in the contract document which shall be complied with the Guaranteed Technical Particulars (GTP) of the Contract. All expenses for such tests shall be borne by the Contractor.

At the time of Factory Test witness BPDB's Inspection Team will check the calibration seal/certificate of the testing/measuring equipment, meters etc. issued by the competent authority. The contractor shall ensure that the Manufacturer shall complete the calibration of the testing/ measuring equipment, meters etc. before the inspection of BPDB's team.

The Supplier shall, after consulting the consignee, give notice to the consignee in writing of the date and the place where the material or equipment will be ready for testing at least 15 days before schedule of inspection. The consignee shall give the supplier timely notice in writing of his intention to attend the test. As and when the consignee is satisfied that any materials/equipment shall have passed the tests referred to in this clause, consignee shall notify the contractor in writing to that effect.

Should any inspected/ tested goods fail to conform to the specification, the consignee shall have the right to reject any of the items or complete batch if necessary. In that case Supplier has to replace the equipment and to make good of them and the supplier shall conduct similar pre-delivery Inspection and factory tests without any financial involvement to the consignee. In case any of the Equipment/goods found not conforming to the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test in respect of quality and quantity. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

If the offered goods are manufactured within the purchaser's country, then the manufacturer/supplier shall have the testing facilities at manufacturer's/supplier's premises in accordance with the relevant IEC/BS/ANSI/ASTM/BDS Standards. The inspector(s) shall sent the sample material (selected by the BPDB's Inspection Team consisting of at least three engineers in each consignment) to CERS,

BPDB/BUET/CUET/KUET/RUET/DUET to carry out any test(s) pending due to lack of testing facilities or any reason at the manufacturer's/supplier's premises. All cost of testing including carrying, loading, un-loading etc. will be borne by the supplier and shall be deemed to be included in the offered price. If the sample(s) fails to confirm the specification, the full consignment will be rejected.

No goods shall be packed, prepared for shipment/delivery unless it has been approved and written instructions have been received from the consignee.

On successful completion of Pre-shipment inspection/quality test witness, delivery of goods will be made to the designated stores under contractor's/supplier's responsibility until Post-Landing Inspection is successfully completed without any obligation on part of BPDB. Quality and quantity of the delivered goods will be determined at the time of post-landing inspection at the designated stores in presence of the authorized representative of the contractor/supplier. After approval of the satisfactory Post-Landing Inspection, R&I Report will be issued following the contractual obligations.

B. RANDOM SAMPLE TEST DURING FACTORY INSPECTION AND WITNESS: Required

During Pre-delivery Inspection & Factory Test Witnessing of the goods to be supplied under the Contract, the Inspection Team will witness the routine tests at the manufacturer's premises. The Inspection Team will select goods on random sampling basis. The Tests shall be performed in accordance with the relevant IEC/BS/ANSI/ASTM/BDS standards or any other standard mentioned in the contract document which shall be complied with the Guaranteed Technical Particulars (GTP) of the Contract. All expenses for such tests shall be borne by the Contractor.

C. ACCEPTANCE REPORT OF GOODS FOR DELIVERY:

If the test results of the tested sample(s) during factory test witness by the BPDB's inspection team fail to confirm the specification and the Guaranteed Technical Particulars (GTP), the full consignment will be rejected. A formal delivery order will be issued after satisfactory pre-delivery inspection & test report by BPDB's inspection team.

D. POST-DELIVERY INSPECTION & TESTING:
Post Landing Inspection shall be done after arrival of the goods at **Final destination**

The Supplier shall inform (within 5 (five) working days) the purchaser or consignee (if consignee is Project Director) immediately after arrival of the goods at the designated store of BPDB (as per delivery schedule). An Inspection team of BPDB (may be the previously or newly formed team) shall start to perform the post-landing inspection not beyond 10 (ten) working days in presence of supplier's representative after getting information from supplier about the delivery of goods at designated store. The Supplier shall arrange post-landing inspection as per program in consultation with the consignee. If any defect or damage has been found at post-landing inspection, the defective or damaged materials/ goods shall be replaced by the supplier at his own cost within the stipulated time.

The purchaser's or consignee's (if consignee is Project Director) right to inspect, test (where necessary) and reject the goods after delivery at the designated stores of BPDB shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the goods' delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. The inspection team will select the sample of good(s) on random sampling basis and sent the selected sample goods to CERS, BPDB or BUET/ CUET/ KUET /RUET (as selected by the inspection team) to carry-out the test(s) as per contract to confirm the conformity to the approved Technical Specifications, Guaranteed Technical Particulars (GTP), drawings and relevant standards. If the tested sample(s) fail to confirm the specifications in tests, the full consignment will be rejected. All cost of testing of Materials/ Goods including carrying, loading, un-loading etc. will be borne by the supplier.

7.2.1 Scope of Supply

This specification covers the design, manufacture, inspection, testing at the manufacturer's works and erection and commissioning of a Substation Automation System described in the following sections, to control and operate the 33/11 kV GIS substation. The scope includes the design, manufacture, supply, installation and commissioning of Substation Automation System (SAS) for both 33KV GIS system with provision for interfacing with SCADA System for 07 Nos. New 33/11kV GIS Substation, 04 Nos. 33/11kV GIS Substation (Up-gradation) and 01 no 33 kV Bay extension.

The Substation Automation System shall have all arrangements to interface with BPDB's SCADA a system. Demonstration by simulation for functional/operational check for future interfacing with SCADA system shall be done by the contractor.

This describes the facilities required to provide the control of plant and system within a substation and outlines the facilities to be provided on site, interface requirements and performance criteria.

The Substation Automation System (SAS) shall comprise full station and bay protection, control, monitoring and communication functions. It shall enable local station control via PC by means of a human machine interface (HMI) and control software package and perform the necessary system control and data acquisition functions. It shall include communication gateway to inter-bay-bus, intelligent electronic devices (IED) for bay control and protection as shown in the enclosed general system architecture drawing.

The communication gateway shall secure control from and information flow to remote network control centres. The inter-bay bus, configured as a star connection (via star couplers) shall provide independent station-to-bay and bay-to-bay data exchange. The bay level intelligent electronic devices (IED) for protection and control shall be directy connected to the instrument transformer without any interposing equipment and perform control, protection, and monitoring functions subject to a detail proposal approved by the Engineer.

The IED's for protection and control functions shall maintain high availability and reliability together with bay independence through extensive self-supervision and state-of-the-art technology.

The system shall be capable of having its computing power increased in the future by the addition of additional computing systems.

The system design life shall be not less than 20 years. The Automation system shall be from EU/USA/UK/Canada/Japan.

The bidder shall provide (i) IEC 61850 compliance report for the offered system with IEDs and (ii) interoperability test report for the offered system with ABB, Siemens, Alstom and SEL IEDs with IEC 61850 protocol from any UCA approved system verification and validation center along with the bid document.

The capacity of the SA system shall be sufficient for the ultimate development of the substation as set out in the project requirements.

The SAS supplier shall demonstrate that the system proposed has been designed, installed and commissioned in accordance with relevant international standards and the specification shall provide evidence of satisfactory service experience during the past 5 years.
The contractor shall provide the installation software and required Licenses of the substation automation system.

Installation, testing and commissioning of substation automation system shall be done by the automation Engineer(s) of the substation automation manufacturer(s).

The software architecture and the database structure shall be finalized with the Purchaser. The facitlities shall be incorporated in order to access the database from the backend by the authorised user of the Purchaser. Object oriented technology shall be used in the software development.

The Source Codes of the software standard documentation shall be handed over to the Purchaser. The standard database like Oracle, MySQL, SQL shall be used.

Cyber Security of this system shall be built in with the system. The objective of cyber security is to protect information and physical assets from damages caused by theft , corruption or natural disasters while allowing the information and assets to remain accessible and productive to employer. All potential causes of cyber attacks need to be considered when employing a defense in depth approach.

7.2.2 Compliance with standards

For design and type testing of the protection and control equipment, the following standards shall be applicable:

General List of Specifications

IEC 255 :	Electrical Relays
IEC 60038:	IEC Standard voltages
IEC 68068:	Environmental testing
IEC 60664:	Insulation co-ordination for equipment within low-voltage systems
IEC 61850:	Standard for Substation integrated protection and control data communication

Detailed List of Specifications

IEC 255-6:	Measuring relays and protection equipment
IEC 255-7:	Test and measurement procedures for electromechanical all-or-nothing relays
IEC 68-2-3:	Test Ca: Damp heat steady state

IEC 68-2-30:	Test Db and guidance; Damp heat, cyclic
IEC 255-5:	Insulation tests for electrical relays
IEC 255-22:	Electrical disturbance tests for measuring relays and protection equipment:
IEC 255-22-1:	1 MHz burst disturbance test
IEC 255-22-2:	Electrostatic discharge test
IEC 255-22-3:	Radiated electromagnetic field disturbance test
IEC 255-22-4:	Fast transient disturbance test
IEC 255-11:	Interruptions to and alternating component (ripple) in D.C. auxiliary energising quantity to measuring relays
IEC 255-6:	Measuring relays and protection equipment
IEC 255-21:	Vibration, shock, bump and seismic tests on measuring relays and protection equipment:
IEC 255-21-1:	Vibration tests(sinusoidal)
IEC 255-21-2:	Shock and bump tests
IEC 255-21-3:	Seismic tests
IEC 255-0-20:	Contact performance of electrical relays
IEC 870-3 class 2:	Digital I/O, Analogue I/O dielectric tests
IEC 801-5/class 3 :	Digital I/O Surge withstand test
IEC 870-3/class2:	Radio interference test
IEC 801-4/4:	Transient fast burst test
IEC 801-2/4:	Static discharge
IEC 801-3/3:	Electromagnetic fields

7.2.3 Design and Operating Requirements

7.2.3.1 General

The SAS shall be suitable for operation and monitoring of the complete substation including future extensions. The offered products shall be suitable for efficient and reliable operation and maintenance support of the substations.

The SA system shall be state-of-the art design suitable for operation in high voltage substation environment, follow the latest engineering practice, ensure long term compatibility requirements and continuity of equipment supply and the safety of the operating staff.

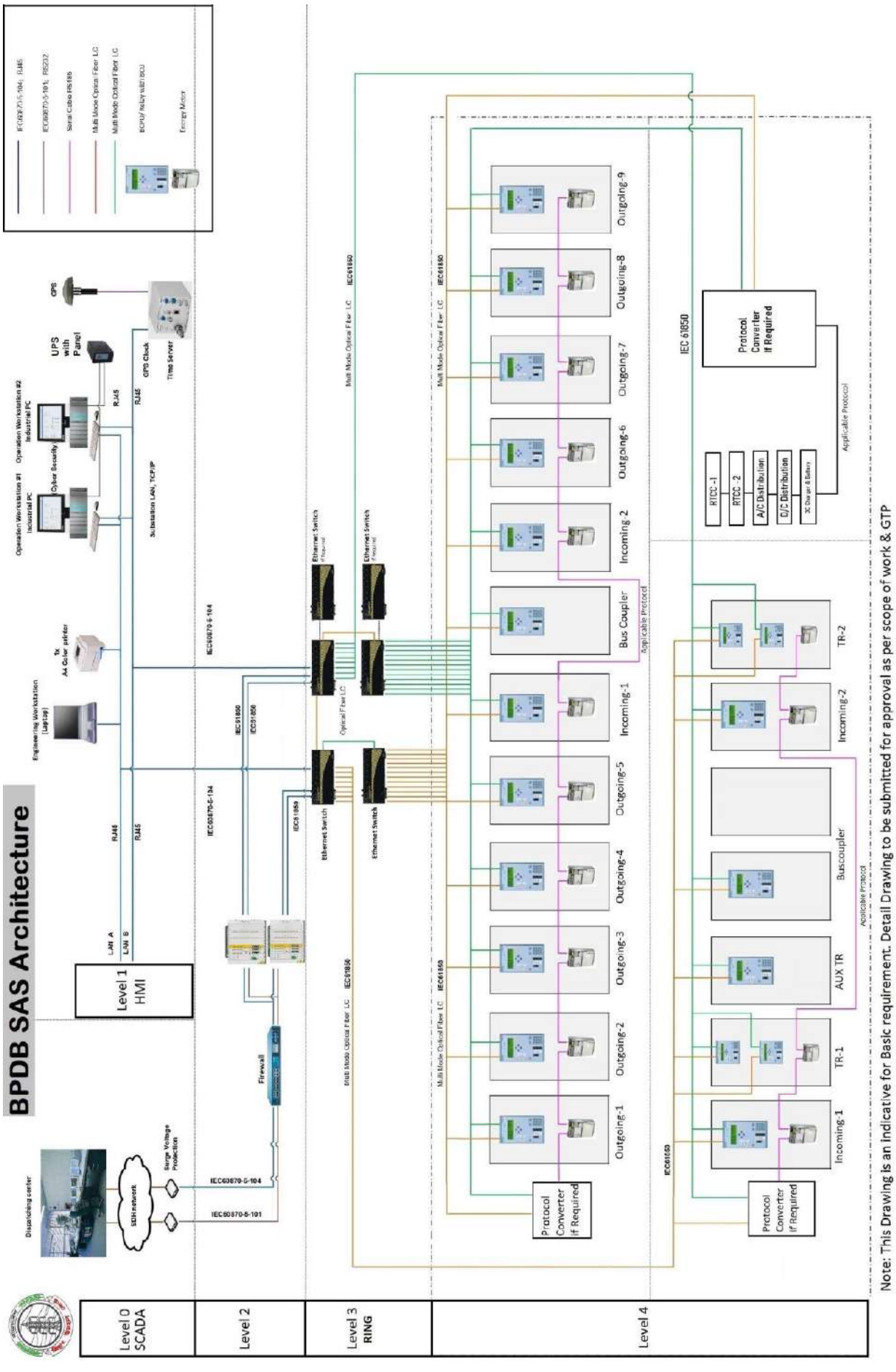
Protection is an integral part of the SA system and protective relays shall be directly connected to the interbay bus in order to provide unrestricted access to all data and information stored in the relays and for changing protection parameters from the remote control location.

Failure behaviour of the hardware and software functions shall be addressed and related diagnostic and rectification working instructions shall be provided. The system performance, if failure of communication to main and redundant computer base workstations, central functions, data model, control and protection IED's, station and bay level communication shall also be clearly addressed (shall be provided by the manufacturer).

The substation can also be controlled from Local Control Panel. The following modes of operation shall be possible

(a) Emergency operation of breaker, disconnector, earthing switch etc. from the Local Panel.

(b) Normal operation of breaker, disconnector, earthing switch etc. from the Station Automation System HMI located in the 1st floor/Ground floor.


BPDB SAS Architecture
Level 0 SCADA
Level 2
Level 3 RING
Level 4
Level 1 HMI
Dispatching center
SDH network
Surge Voltage Protection
IEC60870-5-104
IEC60870-5-101
Firewall
LAN A
LAN B
RJ45
Engineering Workstation (Laptop)
A4 Color printer
Operation Workstation #1 Industrial PC
Cyber Security
Operation Workstation #2 Industrial PC
UPS with Panel
GPS
GPS Clock
Time Server
Substation LAN, TCP/IP
IEC61850
Optical Fiber LC
Ethernet Switch
Multi Mode Optical Fiber LC
Outgoing-1
Outgoing-2
Outgoing-3
Outgoing-4
Outgoing-5
Outgoing-6
Outgoing-7
Outgoing-8
Outgoing-9
Incoming-1
Incoming-2
Incoming 2
Bus Coupler
Buscoupler
AUX TR
TR-1
TR-2
Applicable Protocol
Protocol Converter If Required
IEC 61850
RTCC -1
RTCC -2
A/C Distribution
D/C Distribution
DC Charger & Battery
Note: This Drawing is an indicative for Basic requirement. Detail Drawing to be submitted for approval as per scope of work & GTP

BOQ of SAS:

Substation Automation system		Unit	Qty.
ii.	Industrial Server PC for Operator workstation with SAS & Engineering Software.	Set	02
iii.	Ethernet Switch for SAS	Lot	01
iv.	GPS system	Set	01
v.	Common alarm unit with hooter/buzzer for annunciation	Set	01
vi.	One (01) set of Color Printer	Set	01
vii.	Engineering PC (Laptop) : core i7-9800X series processor, 1TB HDD, 16GB RAM, 15.6" display.	Set	01
viii.	Cable (Fiber Optic, Ethernet, Copper etc.)	Lot	01
ix.	Panel including wiring, lighting , heater & other accessories	Lot	01
x.	Gateway	Set	02
xi.	UPS with Panel (110 V DC from Substation main DC System Source will be provided)	Set	01
xii.	Other Accessories (if any)	Lot	01

7.2.3.2 Modes of Operation

The operator stations and specified remote users shall have following operational modes, each password protected.

Monitoring Ability to select graphic displays and lists for viewing only. No capability to acknowledge alarms, complete controls or select items for inclusion in program functions.

Control: Selection of graphic display and lists. Able to acknowledge station and SA alarms, complete controls, dressing etc. associate with normal real time of the control of the substation.

SA Engineering: Provides all the SA monitoring functions, together with online facilities for program/database/format modifications and checking without the possibility of executing power system controls.

System Manager: Provides access to all system functions, including assignment of passwords and system maintenance activities.

In addition a facility to provide access to the numerical Protection relays, change / modify relay settings & AVR parameters and Fault Recorder data shall be provided.

A series of passwords shall be personally assigned to operators in each of the above categories.

It shall be possible for substation operators to log on either of the substation workstation and to be allocated the appropriate mode of operation relevant to the password. SA System Engineering work and access to the protection relay and disturbance reorder information shall generally be carried out at the Engineering workstation or remote master station.

All the workstation and the system database shall function as a system. It shall not be necessary for example to acknowledge an alarm at more than one workstation.

Similarly, an operator manual entry applied at a workstation shall be immediately displayed at other workstations where this data is presented.

7.2.3.3 Project Specifications

Specific functions required and boundary conditions of the SA are detailed elsewhere in this specification. The project specific drawings are attached:

- Overall single line diagram
- General system architecture
- Location of substation buildings
- Control and operation principles
- Protection schemes

7.2.3.4 Vendor's Experience and Local Support

Only experienced and technically capable manufacturers with minimum 5 years experience in design and supply of control and protection systems for electricity transmission and distribution applications will be accepted. Preferred manufactures will be those who have experience in deliveries of the full scope of station automation systems and services. This experience has to be substantiated by means of reference installations being in service under similar environmental conditions for at least 5 years. In order to assess the vendor's experience with similar projects, the vendor is required to submit the following with his Bid:

- Technical design specifications and description of SA
- Catalogues and brochures of equipment and devices offered
- Reference list

The vendor shall assure for long-term maintenance and availability of spares. Moreover, a guarantee shall be submitted for the availability of spares during the lifetime of the SA equipment (not less than **20** years) **[as specified in GTP].**

One (01) Lot of Complete SAS including all required equipment & accessories excluding relay & protection panel for the whole Substation. SAS system shall include Server PC (Hot & standby) with SAS software and **required licenses**, Operator workstation (Main & redundant), Ethernet Switches, GPS system, Printer, Engineering PC/ **Laptop with all necessary** software **and required licenses**, panels, Cables etc. **The Master slave Licenses for SCADA and SAS communication in the gateway shall be activated.**

The Engineering PC/ **Laptop** & software of SAS shall be useable for engineering of SCADA system also. **The Master slave Licenses for SCADA and SAS communication in the gateway shall be activated.** Therefore, necessary hardware & software shall be installed here.

All required electrical signals for signalization and control shall be transmitted to the SCADA through the Industrial Gateway of the substation automation system or RTU. All breakers, motorized disconnectors, tap changer, etc. shall be controlled form SCADA through the Gateway or RTU of the substation automation system using IEC 60870-5-104 protocol. Necessary transducer, control & interposing relays, RTUs, etc. shall be used. Necessary interfacing between the Substation Automation gateway and the communication equipment is to be carried out. IED shall have dual connection to Ethernet switch (hot & standby). Ethernet switch shall have dual connection to each other.

All DC status (DC voltage status for each bus including coupling breaker on /off status, fail with alarm) excluding control & protection Panel shall be incorporated in substation automation system. The DC status of control & protection Panel shall be incorporated to SAS by individual IED.

7.2.4 General System Design

The system shall be so designed that personnel without any background in microprocessor based technology can operate the system easily after they have been provided with some basic training.

System control from the substation control room will be with the help of an Industrial Computer (PC) operated by a mouse. The following HMI (Human Machine Interface) functions shall be provided:

- Acquisition and plausibility check of switchgear status
- Control of switchgear**, Transformer Fan, OLTC**
- Remote checking of device parameters and activation of alternative parameter sets in the connected protective relays
- Display of actual measured values (U, I, P, Q, f, PF)
- Display of Energy (kWh and kVarh export and import)
- Display of events
- Display of alarms
- Display of trends
- Sequence control functions
- Disturbance records and fault location
- System self-supervision
- Hard copy printing
- **Transformer Health Monitoring**
- **AC distribution system monitoring**
- **DC charging system monitoring**
- **DC distribution system monitoring**
- **Ambient Temperature and Humidity monitoring of Transformer yard, Cable compartment and Control room**
- **Different Operational data (SAIDI, SAIFI, MOD) as a Monthly report**

Maintenance, modification or extension of components shall not require a shutdown of the whole station automation system. Self-monitoring of single components, modules and communication shall be incorporated to increase the availability of the equipment while minimising maintenance time to repair.
The data exchange between the electronic devices shall take place via an inter-bay bus using IEC 61850 protocol. The high speed bus shall permit peer-to-peer communication between the connected devices with democratic access. The entire station shall be controlled and supervised from the station level PC. It shall also be possible to control, monitor and protect each individual bay from the respective bay level equipment for maintenance purposes or if the communication to a particular bay should fail. Clear control priorities shall prevent initiation of operation of a single switch at the same time from more than one of the various control levels viz., station level, bay level or switchgear (apparatus) level. The priority shall always be with the lowest enabled control level.

Each bay control and protection unit shall be independent of each other and its functioning shall not be affected by any fault occurring in any of the other bay control and protection units of the station. Control function can be provided with O/C & E/F relay as Bay Control and Protection Unit (BCPU) in the 33 kV and 11 kV PCM panel. Separate Bay Control Unit (BCU) along with separate OC & E/F relay is also acceptable.

The SAS shall contain the following main functional parts:

- Human Machine Interface (HMI) with process database
- Gateway function for remote control via an industrial grade hardware
- Dial in facility / laptop workstation for protection relay parameterisation, disturbance analysis and SA system fault analysis.
- Data exchange between the different system components via high speed bus
- Bay level devices for control, monitoring and protection
- Bay oriented local control and protection panels with mimic inserts
- Facility for emergency operation of all the switchgear, if bay controller fails. (Key / master key system.)

The main process information of the station shall be stored in distributed databases. The system shall be based on a de-centralised concept with bay oriented distributed intelligence for safety and availability reasons. Functions shall be decentralised, object oriented and located as close as possible to the process.

The substation monitoring/protection system shall supply data for maintenance, repair and remote parameter setting of protection and control devices in the switchyard. In the event of a fault in the electrical network, the substation monitoring shall provide a quick means for collecting the relevant and critical data of the fault.

The monitoring system shall be suitable for the supervision and monitoring of all the secondary (lED) and primary devices in a substation including future extensions.

Maintenance, modification or extension of components shall not cause a shut-off of the whole station monitoring system. Self-monitoring of single components, modules and communication shall be incorporated to increase the availability and the reliability of the equipment and minimise maintenance.

It shall be possible to access all protection and control devices for reading the terminal parameters (settings). The setting of parameters or activation of parameter sets shall be restricted by password to the protection engineer.

7.2.5 Flexibility and Scalability

The offered SA system concept shall be flexible and shall permit future extensions to be realised easily. Preference will be given to those suppliers who are in a position to provide protection and control devices which can be freely adapted to the application functions required.

7.3.6 System Hardware

7.2.6.1 Operator Station

The main operator station shall be based on an industrial PC hardware and high-resolution full-graphics screen with manufacturer's standard type tested software operating under Windows latest environment. An Event printer and a Hard Copy printer shall be connected via a printer server and LAN to the operator station. The CPU shall be installed in the automation panel.

Dual station computers shall control the SA system and drive the work stations and other peripherals. One of the station computers shall operate the system in the "on line" state while the other acts as a "redundant hot standby". The standby computer shall be continuously updated and shall immediately take over the SA system duties without interruption or transfer mechanism should the on line operator workstation fail.

Disturbance Records shall be analysed using the installed Disturbance Record Analysis programmes. The Disturbance Records will be collected, over the interbay bus, from the connected IED's by the system software. All necessary facilities shall be provided to allow the system to perform spontaneous upload of Disturbance data or upload them in a pre-programmed manner. The Event printer shall print events spontaneously as they arrive in the main operator station.

Each uploaded data report file shall be reported on one line that shall contain:

- The event date and time
- The name of the event object
- A descriptive text
- The state or value of the object

The information fields above shall be structured in columns for maximum readability.

The hard copy printer shall permit printing of any picture (or part thereof) from the station level PC's using easily accessible commands from the window menus.

The main Station PC's with monitor and associated equipment of SAS shall be supplied by a UPS system connected with Substation DC battery bank.

7.2.6.2 Station Inter-bay Bus:

The LAN connecting the industrial computer based operator workstations, printers shall be Ethernet 802.3 LAN, Protocol TCP/IP **(100 M.bits/ sec or higher)** and the physical medium shall be thin Ethernet or fiber optic bus, provided this LAN is kept within the confines of the control room.

The bay control and protection units shall be connected via glass fiber optic cables to a station inter-bay bus, operating on high speed bus, via star couplers. The star coupler shall permit the data exchange between the different system components. Glass Fiber optic connections are used in order to avoid EMI in the switchgear and substation environment.

All protection and control units with serial communication facilities are connected in a star topology via glass fiber optics to the star coupler. Under no circumstances shall events from the protections be taken into the system via bay control unit hardware i.e., each protection device should have its own independent fiber optic communication channel to the star coupler. The star couplers shall be mounted in a separate communication cubicle.

7.2.6.3 Protection and Control IED's on 33 kV Level and 11kV Level:

The control IED's, based on microprocessor technology, shall use numerical techniques for the calculation and evaluation of externally input analogue signals. They shall incorporate select-before-operate control principles as safety measures for operation via the HMI. They shall perform all bay related functions, such as protection, commands, bay interlocking, data acquisition, data storage and event recording and shall provide inputs for status indication and outputs for commands. They shall be mounted in the LV compartment of the switchgear and shall be directly connected to it without any need for separate interposing equipment or transducers. All the 33kV & 11kV Circuit Breaker and TPS (DS-ES) shall be operable (ON/OFF) by the bay control unit HMI/protection relay HMI/SAS/SCADA and necessary software based closing & opening interlock shall be implemented.Required numbers of Binary Input, Binary Output, Analog Input, Programmable LED etc. of 33kV & 11kV panel's IED shall be provided to fulfill the requirements of CB,DS & ES control operation and position indication, hardware interlock, software interlock, panel equipment's status indication and all other necessary signals mentioned along with 10% as spare.

The 33 kV bay control & protection IED shall have the following features depending on the requirement:

- Minimum of 8 analogue channels
- For 33kV, not less than 42nos. BI & **32** nos. BO for Transformer Feeder and 24nos. BI & 24nos. BO for incoming& outgoing feeder, 32 nos BI and 24 nos BO for Bus coupler Feeder. For 11kV,

not less than 32 nos. BI & 32 nos. BO for incoming and 24 nos. BI & 24 nos. BO for outgoing feeder, 32 nos BI and 24 nos BO for Bus coupler Feeder.

- 8 nos. programmable LED's on the front of the unit for indication
- Instantaneous Phase Over current Protection
- Instantaneous Earth Fault Protection
- Inverse Time Phase Over current Protection
- Inverse Time Earth Fault Over current Protection
- Over voltage / under voltage Protection
- Synchrocheck function
- Built-in mimic display with controls for operating the switchgear. In the event of failure of the bay unit a backup system for emergency operation should be provided.
- Sufficient number of High speed bus serial communication port electrical and Optical communication ports for Dual channel parallel communication for multiple Ethernet switch.
- Sequence of Events Recorder with a buffer for 256 events and a resolution of 1 msec. The events that are to be recorded should be freely programmable. These could be alarm/trip signals, external signals connected to optocoupler inputs, internal signals, etc. Once events are defined, they are recorded in chronological order as they occur.
- Disturbance Recorder function which can record 9 analogue values, 16 Binary signals and 12 analogue channels for internal measurement values. It shall be possible for the Disturbance Recorder function to be triggered by any internal or external binary signal or internal protective function.
- Comprehensive self-supervision
- Battery-free memory back-up of Event and Disturbance Records
- Logic functions (AND, OR, bistable flip flop, etc.)
- Delay/Integrator function
- Fault Locator
- Disturbance Recorder

*** SAS will be provided considering GTP of GIS and BCPU/Relay should have sufficient BI/BO as per BPDB's requirement.

The numerical bay control IED's shall be mounted together with all the relevant bay protective relays in cubicles of Protection Class IP54 or better. Distributed back-up control mimics with associated switches meters and Indicating LED's shall also be provided on these cubicles. These cubicles shall be installed in an air-conditioned room in the substation.

The distributed backup mimic for Local Control shall be installed next to the bay controller IED, which can be used in case of maintenance or emergency or if bay control IED fails. Local bay control via the back-up control mimic on the Control & Protection cubicles shall incorporate the same user safety measures e.g. bay interlocking, synchrocheck, interlock override user guidance etc. as the station HMI. Local bay control shall be key-locked and the control either from GIS local control panel or station HMI or from remote shall be disabled if the local/remote selector switch on the back-up control mimic is in the 'local' position.

The electronic system has to be provided with functions for self-supervision and testing. Each circuit board shall contain circuits for automatic testing of its own function. Control function can

be provided with O/C & E/F relay as Bay Control & Protection Unit (BCPU) in the 33KV and 11KV PCM panel. Separate Bay Control Unit (BCU) along with separate O/C & E/F relay is also acceptable.

Faults in the bay control IED shall be indicated on a front HMI and a message shall be sent to the station level HMI. The time for fault tracing and replacement of a faulty unit shall be reduced to a minimum. The supervision shall also cover the power supply system, the internal system bus and the ability of the central processing module to communicate with different printed circuit boards.

Failure of any single component within the equipment shall neither cause unwanted operation nor lead to a complete system breakdown. The n-1 criteria must be maintained in worst case scenarios also. Further, a single failure must not have any affect on the primary system, which is monitored and controlled.

Only the backup protection can be incorporated in the bay control unit and not the main protections. Main protection shall be provided separately.

All IED`s shall have at least 5 years of successful proven experience in HV applications and the MTBF for the offered units shall be provided.

7.2.7 Software Structure

The software package shall be structured according to the SA architecture and strictly divided in various levels. It shall be possible to extend the station with the minimum possible effort. Maintenance, modification or extension of components of any feeder may not force a shut-down of the parts of the system which are not affected by the system adaptation.

Confirmation that the software programs will be supported for a minimum of 20 years is required to be submitted with the Bid.

It shall be the responsibility of the contractor to obtain any license required for the operation software. The contractor shall indemnify the client against all claims of infringement of any patent, registered design, copyright, trademark or trade name or other intellectual property right.

7.2.7.1 Station Level Software

7.2.7.1.1 Human Machine Interface (HMI)

The base HMI software package for the operator station shall include the main SA functions and it shall be independent of project specific hardware version and operating system. It shall further include tools for picture editing, engineering and system configuration. The system shall be easy to use, to maintain, and to adapt according to specific user requirements. The System shall contain a library with standard functions and applications.

7.2.7.1.2 Operating System

Windows operating system shall be used for the operator station as it supports several standard system features, e.g support for several Windows office applications, multitasking, security levels, data exchange mechanisms (DDE, OLE), open data base communication standards (ODBC) and a standardised, user-friendly look & feel HMI. The licensed copy of the operating system backup software shall be provided.

7.2.7.2 Bay Level Software

7.2.7.2.1 System Software

The system software shall be structured in various levels. This software shall be placed in a non-volatile memory. Its lowest level shall assure system performance and contain basic functions, which shall not be accessible by the application and maintenance engineer for modifications. The system shall support the generation of typical control macros and a process database for user specific data storage.

7.2.7.2.2 Application Software

In order to ensure robust quality and reliable software functions, the main part of the application software shall consist of standard software modules built as functional block elements. The functional blocks shall be documented and thoroughly tested. They shall form part of a library.

The application software within the control/protective devices shall be programmed in a functional block language.

7.2.8 System Testing

The supplier shall submit a test specification **(Procedure and Report Format)** for factory acceptance test (FAT**) and Pre-commissioning** and commissioning tests of the station automation system for approval. For the individual bay level IED's, applicable Type Test certificates shall be submitted.

The manufacturing phase of the SA shall be concluded by a Factory Acceptance Test (FAT). The purpose is to ensure that the Contractor has interpreted the specified requirements correctly. The general philosophy shall be to deliver a system to site only after it has been thoroughly tested and its specified performance has been verified with site conditions simulated to the extent possible in a test lab. If the FAT involves only a certain portion of the system for practical reasons, it has to be assured that this test configuration contains at least one unit of each and every type of equipment incorporated in the delivered system.

If the complete system consists of parts from various suppliers, the supplier shall arrange interoperability test at factory during stage inspection or FAT. The complete system test shall also be performed at site in the Site Acceptance Test (SAT).

7.2.9 System functions

7.2.9.1 Control Unit Functions

7.2.9.1.1 Control

The different high voltage apparatuses within the station shall either be operated manually by the operator or automatically by programmed switching sequences.

The control function shall comprise:
Commands from different operator places, e.g. from the station HMI, or local control panel according to the operating principle
Select-before execute commands
Operation from only one operator place at a time.
Operation depending on conditions from other functions, such as interlocking, synchrocheck, operator mode, or external status conditions.

The control function shall also include:

Prevention of double operation

- Command supervision
- Selection of operator place
- Block/deblock of operation
- Block/deblock of updating of position indications
- Manual setting of position indications
- Overriding of the interlocking function (Second key switch.)
- Switchgear run time supervision

7.3.9.1.2 Status Supervision

The position of each switchgear, e.g. circuit breaker, isolator, earthing switch, etc., shall be permanently supervised. Every detected change of position shall be immediately visible on the screen in the single-line diagram, recorded in the event list, and a hard copy printout shall be produced. Alarms shall be initiated in cases when spontaneous position changes have taken place.

Each position of an apparatus shall be indicated using two binary auxiliary normally closed (NC) and normally open (NO) contacts. An alarm shall be initiated if these position indications are inconsistent or indicate an excessive running time of the operating mechanism to change position.

7.3.9.1.3 Interlocking

The interlocking function prevents unsafe operation of apparatuses such as isolators and earthing switches within a bay or station wide. The operation of the switchgear shall only be possible when certain conditions are fulfilled. The interlocking function is required to be decentralised so that it does not depend on a central control device. Communication between the various bays for the station interlocking shall take place via bay communication system. An override function shall be provided, which can be enabled to by-pass the interlocking function via a key/password, in cases of maintenance or emergency situations.

7.2.9.1.4 Measurements:

Analogue inputs for voltage and current measurements shall be connected directly to the voltage transformers (VT) and the current transformers (CT) without intermediate transducers. The correlated values of active power (W), reactive power (VAr), frequency (Hz), and the rms values for voltage (U) and current (I) shall be calculated. **Transformer area/ Switchyard area and** Control room temperature and humidity readings shall be available in SAS.

7.2.9.1.5 Event and Alarm Handling:

Events and alarms shall be generated either by the switchgear, by the control devices and by the station level unit. They shall be recorded in an event list in the station HMI. Alarms shall be recorded in a separate alarm list and appear on the screen. All or a freely selectable group of events and alarms shall also be printed out on an event printer. The alarms and events shall be time tagged with a time resolution of 1 ms. The time tagging shall be done at the lowest level where the event occurs and the information shall be distributed with the time tagging.

7.2.9.1.6 Time Synchronisation:

The time within the SA shall be set via a GPS Clock Receiver connected directly to the Bay Level LAN. The time shall then be distributed to the control/protective devices via the high speed optic fibre bus. An accuracy of ±1 ms within the station is required.

7.2.9.1.6 Synchronism and Energising Check

The synchronism and energising check functions shall be distributed to the control and/or protective devices and shall have the following features:

- Adjustable voltage, phase angle, and frequency difference.
- Energising for dead line - live bus, or live line - dead bus.
- Settings for manual close command and auto-reclose command shall be adaptable to the operating times of the specific switchgear.

7.2.9.1.7 Voltage Selection

The voltages, which are relevant for the synchrocheck functions, depend on the station topology i.e. on the positions of the circuit breakers and/or the isolators. The correct voltage for synchronising and energising is derived from the auxiliary switches of the circuit breakers, isolator, and earthing switch and shall be selected automatically by the control and protection IED.

7.2.9.2 HMI Functions

7.2.9.2.1 General

The operator station HMI shall provide basic functions for supervision and control of the substation. The operator shall give commands to the switchgear via the station monitor with the help of mouse clicks on soft-keys.

The HMI shall provide the operator with access to alarms and events displayed on the screen. Besides these lists on the screen, there shall be a print out of hard copies of alarms or events in an event log. The Alarm List shall indicate persisting and fleeting alarms separately.

An acoustic alarm shall indicate abnormalities and all unacknowledged alarms shall be accessible from any screen selected by the operator.

Following standard pictures shall be available from the HMI:

a. Single line diagram: SLD showing Actual connection of Feeders and Transformer with bus, having different color for different voltage level, the switching status (Dynamic Color Change with status) and measured values
b. Feeder Page: Each and Every panels of the substation shall have separate window/ page in HMI for all the information related to that panel. A SLD with dynamic color coding and also showing the status in the text form (Open/ Close/ Intermediate). A portion of window shall show all the measurement data for related feeder. LV compartment Alarm signals and Protection Alarm shall also appear in different block in the HMI page.
c. Control dialogues: (Whenever a click performed on any switching device, a pop-up will appear with open and close icon having standard color. When a single command is selected a questions for pop-up for ensuring the operation with accept and deny option) Control can only be performed from feeder specific HMI page.
d. Measurement dialogues: All the feeders page on HMI shall have a portion for display of measurement (3 phase Voltage line -line, phase to phase, 3 Phase Current, MW, MVar, PF, Frequency, Last Fault Current and Voltage for all three phase with respective time, and Distance of fault for line feeder), Transformer feeder shall have additional page /window for measurement Value of HT and LT side Voltage, current, angle values and Differential and Restraining Current.
e. Blocking dialogues: Switchgear operation Interlock shall be implemented in SAS. When a switchgear operation is in interlocked condition with one or more parameter, a LOCK sign shall appear beside the switchgear symbol. After clicking the LOCK symbol/sign, a pop-up will appear showing the parameters/ variables for respective switchgear operation condition in logic diagram with dynamic color coding.
f. Alarm list, station / bay oriented: A common alarm list shall be configured for all the substation signals except manual switchgear operation by operator. Feeder panel wise (including DC Charger panel, DC Distribution panel, AC distribution Panel and SAS panel) Alarm list shall also be configured. Alarms shall be classified on Priority base (Critical, High, Medium, Low) and Status base (Active-Unacknowledged, Active-Acknowledged, Cleared- Unacknowledged, Cleared- Acknowledged) Different types of process signals shall have different color code. A legend shall be available for the color codes.
g. Event list, station / bay oriented:
h. Trends: All the Feeder specific and common real-time measurement parameter data shall be present in trend and the selection of parameter to be displayed in the HMI shall be configurable. A pop-up shall appear and follow the cursor on the trends to show the corresponding Y-Axis value for every parameter present in trend display. Trends shall have another tab for display of Real time data of different parameters in Analog Dial display.
i. Transformer Health Monitoring: Transformer Oil temperature, Winding Temperature indicator shall have a real time data trend in SAS HMI and A historical report shall be generated for OTI, WTI value for Transformer Healthiness check. Fan status shall be available in HMI with Dynamic visual presentation. Dynamic and Real time data of Oil level shall be present in the HMI. There will be a Different Page for Transformer Status. Transformer Fan status and Control shall be integrated to SAS. A report shall be generated for a selected duration having half hourly data of Transformer Phase respective Voltage, Currents, MW, Mvar, OLTC position, OTI, WTI, value, Fan Status, Transformer Yard Temperature and Humidity etc.

j. System status: This HMI screen shall have different tabs for all the SAS equipments (such as OWS, RTUs, Gateway, Firewall, Ethernet switches, BCPUs, Different controllers and others) Health monitoring and real time status
k. Checking of parameter setting
l. DC charger shall have to be interfaced with SAS system. Charger shall monitor all voltage level and physical condition of battery cells.
m. DC Distribution panels shall have a controller that can be connected to SAS and can monitor all DC distribution MCBs status.
n. AC distribution panels shall have Measurement monitor with distribution MCBs status. The monitor shall be integrated to SAS.
o. Control room AC, Access control (Finger print and Password Protection) shall be integrated to SAS. Switchyard Temperature and Humidity shall also be integrated to SAS.

7.2.9.2.2 HMI Design Principles

Consistent design principles shall be provided with the HMI concerning labels, colours, dialogues and fonts. Non-valid selections shall be dimmed out.

Object status shall be indicated using different status colours for:

- Selected object under command
- Selected on the screen
- Not updated, obsolete value, not in use or not sampled
- Alarm or faulty state
- Warning or blocked
- Update blocked or manually updated
- Control blocked
- Normal state
- Busbar colouring to show live & dead bus

7.2.9.2.3 Process Status Displays and Command Procedures

The process status of the substation in terms of actual values of currents, voltages, frequency, active and reactive powers as well as the positions of circuit breakers, isolators and transformer tap changers are displayed in the station single line diagram.

In order to ensure a high degree of security against unwanted operation, a special "select – before - execute" command procedure shall be provided. After the "selection" of a switch, the operator shall be able to recognise the selected device on the screen and all other switchgear shall be blocked. After the “execution” of the command, the operated switch symbol shall blink until the switch has reached its final new position.

The system shall permit the operator to execute a command only if the selected object is not blocked and if no interlocking condition is going to be violated The interlocking conditions shall be checked by the interlocking scheme which is implemented on bay level.

After command execution, the operator shall receive a confirmation that the new switching position is reached or an indication that the switching procedure was unsuccessful with the indication of the reason for non-functioning.

7.2.9.2.4 System Supervision Display

The SA system shall feature comprehensive self-supervision such that faults are immediately indicated to the operator before they possibly develop into serious situations. Such faults are recorded as faulty status in a system supervision display. This display shall cover the status of the entire substation including all switchgear, IED's, communication links, and printers at the station level etc.

7.2.9.2.5 Reports

The SA shall generate reports that provide time related information on measured values and calculated values all accessed from Energy meter. The data displayed shall comprise:

Trend reports:

- Day (mean, peak)
- Month (mean, peak)
- Semi-annual (mean, peak)
- Year (mean, peak)

Historical reports:

- Day
- Week
- Month
- Year

It shall be possible to select displayed values from the database on-line in the process display. Scrolling between e.g. days shall be possible. Unsure values shall be indicated. It shall be possible to select the time period for which the specific data are kept in the memory.
This report shall be printed automatically at pre-selected times. It shall also be possible to print this report on request.

7.2.9.2.6 Trend Display (Historical Data)

A trend is a time-related follow-up of process data. The analogue channels of all the connected bay level devices on the 33 kV level shall be illustrated as trends. The trends shall be displayed in graphical form as columns or curve diagrams with 10 trends per screen as maximum.

It shall be possible to change the type of value logging (direct, mean, sum, or difference) on-line in the window. It shall also be possible to change the update intervals on-line in the picture as well as the selection of threshold values for alarming purposes.

7.2.9.2.7 Event List

The event list shall contain events, which are important for the control and monitoring of the substation. The time has to be displayed for each event.

The operator shall be able to call up the chronological event list on the monitor at any time for the whole substation or sections of it.

A printout of each display shall be possible on the hard copy printer.

The events shall be registered in a chronological event list in which the type of event and its time of occurrence are specified. It shall be possible to store all events in the computer. The information shall be obtainable also from printed event log.

The chronological event list shall contain:

- Position changes of circuit breakers, isolators and earthing devices.
- Indication of protective relay operations
- Fault signals from the switchgear
- Violation of upper and lower limits of analogue measured value.
- Loss of communication

Filters for selection of a certain type or group of events shall be available. The filters shall be designed to enable viewing of events grouped per:

- Date and time
- Bay
- Device
- Function
- Alarm class

7.2.9.2.8 Alarm List

Faults and errors occurring in the substation shall be listed in an alarm list and shall be immediately transmitted to the control centre. The alarm list shall substitute a conventional alarm tableau, and shall constitute an evaluation of all station alarms. It shall contain unacknowledged alarms and persisting faults. Date and time of occurrence shall be indicated.
The alarm list consists of a summary display of the present alarm situation. Each alarm shall be reported on one line that contains:

- The alarm date and time

- The name of the alarming object
- A descriptive text
- The acknowledgement state

The operator shall be able to acknowledge alarms, which shall be either audible or only displayed on the monitor. Acknowledged alarms shall be marked at the list.

Faults that appear and disappear without being acknowledged shall be specially presented in a separate list for fleeting alarms. For example due to bad contacts or intermittent operation.
Filters for selection of a certain type or group of alarms shall be available as for events.

7.2.9.2.9 Object Picture

When selecting an object such as a circuit breaker or isolator in the single line diagram, first the associated bay picture shall be presented. In the selected object picture, all attributes such as-

- type of blocking,
- authority
- local / remote control
- SA control
- errors,
- etc., shall be displayed.

7.2.9.2.10 Control Dialogues

The operator shall give commands to the system by means of soft keys located on the single line diagram. It shall also be possible to use the keyboard for soft key activation. Data entry is performed with the keyboard.

7.2.9.2.11 User Authority Levels

It shall be possible to restrict the activation of the process pictures of each object (bays, apparatus, etc.) to a certain user authorisation group. Each user shall then be given access rights to each group of objects, e.g.:

- Display only
- Normal operation (e.g. open/close apparatus)
- Restricted operation (e.g. by-passed interlock)
- System administrator

For maintenance and engineering purposes of the station HMI, the following authorisation levels shall be available:

- No engineering allowed
- Engineering/configuration allowed
- Entire system management allowed

The access rights shall be defined by passwords assigned during the log-in procedure. Only the system administrator shall be able to add/remove users and change access rights.

7.2.9.3 System Performance

The refresh/update times on the operator station PC under normal and calm conditions in the substation shall be according to the levels specified below:

Function	Typical values
Exchange of display (first reaction)	< 1 s
Presentation of a binary change in the process display	< 0.5 s
Presentation of an analogue change in the process display	< 1 s
From order to process output	< 0.5 s
From order to update of display	< 1.5 s

7.2.9.4 System Reliability

The SA system shall be designed to satisfy very high demands for reliability and availability concerning:

- Solid mechanical and electrical design
- Security against electrical interference (EMI)
- High quality components and boards
- Modular, well-tested hardware
- Thoroughly developed and tested modular software
- Easy-to-understand programming language for application programming
- Detailed graphical documentation, according to IEC 1131-3, of the application software
- Built-in supervision and diagnostic functions
- After sales service
- Security
- Experience of security requirements
- Process know-how
- Select before execute at operation
- Process status representation as double indications
- Distributed solution
- Independent units connected to the local area network
- Back-up functions
- Panel design appropriate to the harsh electrical environment and ambient conditions
- Panel grounding to provide immunity against transient ground potential rise

7.2.9.5 Configuration Tools:

The configuration of the station HMI shall be made using the operator station working in Windows environment. The various functions shall be customised by easy to use interactive configuration tools. Configuration shall include the visual presentation of the object, adaptations needed in process database and adaptations of the communication configuration data.

A portable Personal Computer (PC) as a service unit shall be foreseen for on-site modifications of the control and protection devices. The service unit shall be used for documentation, test and commissioning.

The PC based service & support system shall be used for the following purposes:

- System configuration
- System testing
- Help functions
- Program documentation
- Down- and up-loading of programs
- System commissioning
- Data base management
- Changing peripheral parameters

The service & support system shall be able to monitor data in the running substation control system and to present changing variables on the display screen in graphic representation.

7.2.9.6 Information Required

The following documentation shall be provided for the system during the course of the project and they shall be consistent, CAD supported, and of similar look/feel:

- List of Drawings
- Control Room Lay-out
- Assembly Drawing
- Single Line Diagram
- Block Diagram
- Circuit Diagram
- List of Apparatus
- List of Labels
- Functional Design Specification (FDS)
- Test Specification for Factory Acceptance Test (FAT)
- Logic Diagram
- List of Signals
- Operator's Manual
- Troubleshooting Manual
- Product Manuals
- Calculation for uninterrupted power supply (UPS) dimensioning
- Licensed Copy of all software
- Third Party cyber security certification

7.2.9.10 Documentation required

Submission of Type Test Reports/ Certificate as stated in per relevant IEC from recongnized independentlabrotories.

7.2.9.11 Technical Orientation and Quality Test Witness (Acceptance test) of SAS :

The employer / purchaser shall have the right to inspect/test the automation system to confirm their conformity to the specification. The purchaser shall be entitled at all

reasonable time during manufacture to inspect, examine and test of automation system at the manufacturers' premises, workmanship and performance.

The following test shall be carried out as per latest version of IEC or equivalent standard unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available:-

- Routine tests
- **Demo test run of SAS from SCADA System at Manufacturer's premises.**

The Supplier shall, after consulting the purchaser, give the Purchaser reasonable notice in writing of the date on and the place at which any material or equipment will be ready for testing as provided in the contract and unless the purchaser shall attend at the place so named on date, which the supplier has stated in his notice, the supplier may proceed with the tests, which shall be deemed to have been made in the purchaser's presence, and shall forth with forward to the purchaser duly certified copies of test readings.

When the purchaser intends to attend the test he shall promptly inform the supplier accordingly in writing, so that he can take action. The purchaser shall give the supplier timely notice in writing of his intention to attend the test.

Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These test shall be performed as per relevant IEC Standard or equivalent and only routine tests as agreed upon, will be performed.

As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect.

Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the item or complete batch if necessary. In that case Supplier has to replace the Equipment and to make good of them without any financial involvement to the Purchaser. In case any of the Equipment found not conforming withthe specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

7.3.0 TECHNICAL SPECIFICATIONS FOR 33/11 KV SUBSTATION EQUIPMENT

7.3.1 Scope

This clause describes the General Technical Requirements for the new 33 KV Circuit Breaker with PCM and 11KV AIS Switchgear and general switchyard equipment, and shall be read in conjunction with the Project Requirements, Schedules and Drawings in the specification.

The Contractor shall demonstrate that the switchgear has been designed, built and installed in accordance with the relevant international standards and the specification as specified in the tender documents. It shall also operate and perform on a site in accordance with the requirements of the specification and in the environment defined herein.

The design shall be proven by the submission at the time of Tender of test certificates covering all specified tests deemed to be pertinent to the plant and to the conditions in which it will operate or, if such test certificates cannot be supplied or are deemed unacceptable by the Engineer, type tests which will be subject to the conditions of this Contract shall be carried out at no extra cost to the Employer.

The requirement for switchgear spares, tools and appliances, including test, maintenance and handling equipment shall be as stated in the tender document.

7.3.2 REFERENCES

7.3.2.1 British Standards

BS	159	Specifications for HV bus bars and bus bar connections
BS	1977	Specifications for high conductivity copper tubes for electrical purposes
BS	2898	Specifications for wrought aluminium for electrical purposes. Strip with drawn or rolled edges.
BS	3938	Specification for current transformers.
BS	5253	Specifications for AC disconnectors and earthing switches.
BS	6651	Lightning Protection
BS	7354	Code of practice for design of HV open terminal stations.

7.3.2.2 IEC Standards

1.	IEC 62271	HV Switchgear and Controlgear.
2.	IEC 60376	Specification and acceptance of new sulphur hexafluoride
3.	IEC 60480	Guide to checking of sulphur hexafluoride taken from electrical equipment.
4.	IEC 60060	High Voltage test techniques.
5.	IEC 60071	Insulation Co-ordination
6.	IEC 60099-5	Surge arresters Part 5: Selection and application reccommandation
7.	IEC 60129	AC disconnectors (isolators) and earthing switches
8.	IEC 61869-1&2	Current transformers.
9.	IEC 61869-1&3	Voltage transformers.
10.	IEC 60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
11.	IEC 61850	Communication network and system in substation
12.	IEC 60529	Degrees of protection provided by Enclosure (IP code)
13.	IEC 60255	Electrical relays
14.	IEC 62271-1	High voltage switchgear and control gear: common specification
15.	IEC 62271-100	High voltage switchgear and control gear: Part 100: Alternating current circuit breakers
16.	IEC 62271-102	High voltage switchgear and control gear: Part 102: Alternating current disconnector and earthing switch

7.3.3 33 KV VACUUM CIRCUIT BREAKER

1.	Installation	:	Outdoor Sub-station.
2.	Type	:	Vacuum Circuit Breakers
3.	Number of Phase	:	3 (Three)
4.	Operation	:	Single Break in Service/ Pole
5.	Nominal Voltage	:	33 KV
6.	Maximum Operating Voltage	:	36 KV
7.	Frequency	:	50 Hz
8.	Rated Current for	:	**1600A/2500A**
9.	Symmetrical Breaking Capacity	:	1800 MVA
10.	Asymmetry	:	50%
11.	Short Time Current Duration	:	40 kA (3 Sec.) for 2500 A , 31.5 kA(3 Sec.) for 1600 A
12.	Making Current (Peak) KA	:	102KA for 2500 A /80KA for 1600 A
13.	Opening Time (Maximum)	:	0.05 Sec.
14.	Breaking Time	:	<3 Cycle
15.	Capacity of Vacuum Interrupter at rated short circuit current switching	:	≥50 nos. of operations
16.	Basic Insulation Level (1.2/50 Micro Second Wave)	:	170kVp
17.	Power Frequency Test Voltage (Dry)		70 KV at 50 Hz, 1 Min.
18.	Rated Operating Sequence	:	O - 0.3 Sec – CO – 3 min – CO
19.	Standard	:	Design, Manufacture, Testing, Installation and Performance shall be in accordance with the latest edition of IEC–60056 & IEC-62271-100
20.	FEATURES - Circuit Breaker terminal connectors shall be suitable for ACSR Merlin, Gros Beak (636MCM). - Grading terminal connector. - All current carrying parts shall be made of copper including top & bottom pad/terminals. - Externally visible circuit breaker position indicator. - Electrically remote controlled operating mechanism. - Shall be capable of the interrupting duties produced by the switching of transformer magnetizing current and the switching of line charging current. Tests certificate demonstrating this ability of the circuit breakers shall be submitted with the offer. - Circuit Breaker closing mechanism shall be 230 volt AC motor wound spring-operated type such that the closing speed is independent of the operator. Spring charging motor shall be AC driven Universal motor. Rectifier in motor circuit is not acceptable. - Shall have two tripping coils and one closing coil. Trip coil and close coil shall have freewheeling diode installed. - Hand closing and tripping shall be done through manual levers. - Trip free mechanism as specified in IEC 60056-1 i.e. tripping is independent. - Local “Close” and “Trip” controller. - VCB should be re-strike free. - VCB should be trip free. - Operation Counter. - Supporting Steel Structure. - Bushing Insulator as Specified in latest version IEC-60137.		

	- Weather proof sheet steel control kiosk, with hinged door on three sides and necessary multi-core cable glands. Controls from this position will normally is used under maintenance and emergency conditions only. AC 230V lighting system inside the door of control kiosk shall be provided. - ARC suppression type contacts. - Manually operating devices for slow closing for inspection and maintenance. It shall not be possible to slow close a breaker when in normal services. - Earthing pad with provision for earth leads. - Standard sundries like anti-condensation heaters, MCBS wiring board etc. Facilities to be incorporate for tripping and lockout of the breaker in the event Vacuum failure falling below stipulated value. - Rating plate and diagram plate shall be made of stainless steel and have engraved letters filled with black enamel paint with clear visibility. - Evidence of prototype tests together with test certificate from an internationally reputed/accredited institution covering the equipment shall be furnished with the offer. The test duty shall be as per the requirements of IEC–60056. Laminated control & protection drawing set shall be fitted/supplied inside the control box/kiosk. - Motor-driven, spring charged - Automatically charged after each closing operation - O-C-O operation without recharging - Mechanical / electrical interlocking, anti-pumping - Provision for manual charging - Manual closing and tripping arrangement - Mechanical ON-OFF, operation counter and spring-charged indication - All necessary positive interlocks installed, as per IEC guidelines. - Marking and data to be shown on the Nameplate will be as per approval.

7.3.3.1 INFORMATION REQUIRED for Outdoor type VCB

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information/ Documents have to be submitted:-

a) The Bidder/ Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.
b) Construction, Installation, Operation & Maintenance Manual.
c) Outline, Dimensional, Cross-sectional & General arrangement drawings of offered type equipment with mounting structure arrangement.

Manufacturer's printed catalogue describing specification and technical data of the offered type equipment.

7.3.3.2 TEST CERTIFICATES:

The following test certificates along with test results for offered similar or higher Ampere rating **VCB** for same voltage class from any short-circuit testing liaison (STL) Member [*http://www.stl-liaison.org/web/03_Members.php*] Testing Organization or Laboratory as per relevant IEC standard. The type test report along with results shall include at least the following tests:

a) Lightning Impulse Voltage withstand tests
b) Power Frequency Withstand Tests
c) Temperature Rise tests.
d) Measurement of Resistance of the main circuit.
e) Short-time withstand current and peak withstand current tests.

f) Mechanical Endurance tests
g) Short Circuit performance tests.
h) Out of phase making & breaking tests
i) IP55 tests

7.3.3.3 Special TEST CERTIFICATES:

The following test certificates along with test results for offered similar or higher Ampere rating **VCB** for same voltage class from independent Testing Organization or Laboratory as per relevant IEC standard.

a) Dielectric tests
b) Short-circuit current making & breaking tests
c) Mechanical operation test at ambient temperature
d) Additional tests on auxiliary and control circuits
e) Tightness test
f) EMC test

7.3.3.4 TESTS AT MANUFACTURERS WORKS FOR OUTDOOR TYPE VCB

General

Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests.

MATERIAL TESTS

The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

TYPE TEST

Type tests are required to prove the general design of the offered equipments/ materials. The Tenderer shall submit the type test reports of the offered equipments/ materials from as per relevant clause.

ROUTINE TESTS

All equipments/ materials shall be subjected to routine tests as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract at the manufacturers works and shall include, but not be limited to, an operational test.

7.3.4 33KV PCM PANEL

7.3.4.1 General

The panels shall be vermin and dust proof free standing type completely metal enclosed by sheet steel (minimum 1.62 mm thick) with necessary reinforcement color gray with appropriate spray painting. The approximate dimension of the PCM panel shall be 2100 mm (Height) x 900 mm (Width) x 700 mm (Depth) while viewed from the front side, suitable for opening at the back by hinged door with locking arrangement. The panels shall be neatly and completely wired before shipment.

The work relating to protection, control and panels for 33/11KV Sub-stations shall comprise of development of elementary diagram, design, manufacture, test and supply of pre-wired control panels to be installed in the sub-station control room. The protection, control and panels are to be pre-wired with relays and meters in position. The elementary primary diagram shall be produced giving a clear representation of each protection, control and metering function. The

standard design, drawing, manufacturing, testing & performance shall be in accordance to the IEC-298 standards.

7.3.4.1 A 33 kV Protection, Control, Metering and Relay Panel For Power Transformer, each Panel comprising:

1.	Indicating analogue Ampere meter flush mounting with dual scales options, 0-300/600A for connecting to current transformer ratio 300-600/5-5-5A for 5/6.67 MVA, 10/13.33MVA , 16/20 MVA Power Transformer.	3 (three) nos.
2.	Indicating analogue voltmeter with seven position selector switch flush mounting with scales 0-40 KV for connection to potential transformer ratio (33/√3)/ (0.11/√3)/(0.11/√3) KV, (50 Hz).	1 (one) set
3.	a) Numerical Programmable Multifunctional type MFM Meter It shall be capable of measuring and displaying MW, MVAR, PF, V, I, f, ø etc. distinguishing import and export operation.	1 (one) no.
	b) 3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWh meter of class of accuracy 0.2S with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with demand, KVAR, Power factor etc.	1 (one) no.
4.	Numerical programmable type Three Phase combined Over Current and Earth fault protection relay of 5 Amps, 50 Hz, 110V dc, 3 second operating time ratings having 3 (Three) over current units and one earth fault with current setting range of the O/C & E/F relay shall be from **0.1*In to 40*In** (where In is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays shall have both IDMT & DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability with all other necessary protection & monitoring functions. The relays are housed in a horizontal, flush mounting draw-out case (tropicalized) with self-reset trip relay (relaying 02 nos. NO contacts as spares) (Not to be included in Differential Relay). The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation. Necessary Binary I/O module along with the relay (alternately separate BCU will also be accepted) shall be provided for SAS/SCADA operation.	1 (one) set
5.	Numerical programmable type Differential relay with REF inbuilt feature for 33/11KV, 5/6.67 MVA, 10/13.33MVA, 16/20 MVA Power Transformer. Scheme of REF protection (High/Low impedance) shall be mentioned clearly. The relay(s) are housed in a horizontal, flush mounting draw-out case (tropicalized) with hand & electrical reset trip relay (having 02 nos. NO contacts as spares). Differential relay shall have user defined 3 nos. curves for differential and REF protection with second and fifth harmonic blocking features. The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation.	1 (one) set
6.	Separate Auxiliary Flag Relays for Device/Self Protection of Power Transformer to be provided. The following Auxiliary Flag Relays shall be available - OTA, OTT, WTA, WTT, **MAIN BA, MAIN BT, OLTC Surge Alarm, OLTC Surge Trip**, PRD for main tank & OLTC, **Oil level low/high for main tank & OLTC** etc. All the mentioned Alarm signals shall be incorporated in SAS.	1 (one) set

7.	OLTC Tap position indicator & Lower/Raise push-button switches with blinking feature along with AVR relay etc. AVR relay shall have IEC-61850 communication protocol for SAS. The panel shall be equipped with Oil & winding temperature indication meter, auto/manual selection switch for tap lower/rise operation and master/follower control function for facilitate parallel operation of transformers and appropriate data communication port have to be provided. Also it shall have local/remote selector switch, fan start & stop controlling push button/electrical switch with manual/auto operation mode selection. Indication LED for fan running (Red), fan stop (Green), OLTC in progress (Yellow) etc. shall be provided. Annunciation for OLTC out of step, OLTC faulty/motor tripped, OLTC max./min. position etc. along with other transformer's self-protection alarm & trip signals shall be provided. Annunciator shall have 30 or more window for facilitate all the alarm & trip signals mentioned with built in buzzer/hooter and accept, reset & test push button/electrical switch. . **These facilities can also be provided in separate panel (RTCC).**	1 (one) set
8.	All necessary switches (Local and remote selector switch, TNC switch, etc.), CT terminal blocks with inbuilt isolating, shorting & jacking facility for test purpose, PT terminal blocks with inbuilt isolating & jacking facility for test purpose, signaling set lamps, trip circuit supervision relay for each trip circuit coil, PT supervision relay, auxiliary relay, MCB, fuse and provision for lighting etc. terminal blocks, mimic diagram with circuit breaker control indicating switches and isolating position indicating switches, indicating lamps shall be provided to indicate "Spring Charge"/ readiness for closing and healthy trip circuit indicating readiness for tripping. The mimic and positions of circuit breaker control cum position indicating switch and isolator position indicating switch arrangement in the panel. Mimic diagram shall contain LED based Semaphore Indicator for Isolator/Breaker/Earth switch position. The annunciator shall have 30 or more windows for facilitate transformer related all the alarm & trip signals and OLTC related alarm and indication signals and have built in buzzer and AC/DC fail relay.	1 (one) set
9.	70 W, 230 V AC, Single Phase heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater	1 (one) set
10.	Master Trip relays (02 Nos,)	1 (One) set

7.3.4.1 B 33 KV PROTECTION, CONTROL, METERING AND RELAY PANEL FOR LINE FEEDER (INCOMING /OUTGOING), each comprising:

1.	Indicating analogue Ampere meter flush mounting with dual scales option (0-400A/800A) for connecting to the current transformer ratio 400-800/5-5A for Line Feeder.	3 (three) nos.
2.	Indicating analogue voltmeter with six position selector switch flush mounting with scales 0-40 KV for connection to potential transformer ratio (33/√3)/ (0.11/√3)/(0.11/√3) KV, (50 Hz).	1 (one) set
3.	a) Numerical Programmable Multifunctional type MFM Meter It shall be capable of measuring and displaying MW, MVAR, PF, V, I, f, ø etc. distinguishing import and export operation.	1 (one) no.
	b) 3 phase, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWh meter of class of accuracy 0.2s with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with demand, KVAR, Power factor etc.	1 (one) no.

4.	Numerical programmable type Three Phase combined Over Current and Earth fault protection relay with directional feature of 5 Amps, 50 Hz, 110V dc, 3 second operating time ratings having 03 (Three) over current units and 01(one) earth fault with current setting of 50 to 200% and one earth fault unit with current setting range of the O/C & E/F relays shall be from **$0.1*I_n$ to $40*I_n$** (where I_n is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays shall have both IDMT & DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability with all other necessary protection & monitoring functions.The relays are housed in a horizontal, flush mounting draw-out case (tropicalized) with self-reset trip relay (relaying 02 nos. NO contacts as spares). The numerical programmable relay shall have IEC 61850 communication protocol suitable for SAS implementation. Necessary Binary I/O module along with the relay (alternately separate BCU will also be accepted) shall be provided for SAS/SCADA operation. All the numerical relays of 33kV Incomer & Outgoing Panel shall have built in synchrocheck (25) function.	1 (one) set
5.	All necessary switches (Local and remote selector switch, TNC switch, etc.), CT terminal blocks with inbuilt isolating, shorting & jacking facility for test purpose, PT terminal blocks with inbuilt isolating & jacking facility for test purpose, signaling set lamps, trip circuit supervision relay for each trip coil, PT supervision relay, auxiliary relay, MCB, fuse and provision for lighting etc. terminal blocks, mimic diagram with circuit breaker control indicating switches and isolating position indicating switches, indicating lamps shall be provided to indicate “Spring Charge”/ readiness for closing and healthy trip circuit indicating readiness for tripping. The mimic and positions of circuit breaker control cum position indicating switch and isolator position indicating switch arrangement in the panel. Mimic diagram shall contain LED based Semaphore Indicator for Isolator/Breaker/Earth switch position. The Annunciator shall have at least 14 windows and have built in buzzer and AC/DC fail relay.	1 (one) set
6.	70 W, 230 V AC, Single Phase heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater	1 (one) set
7.	Master Trip relay (01 Nos,)	1 (One) set

7.3.4.1 C FOR 33 KV PANEL FEATURES:

Each PCM panel shall be equipped with the following:

a.) Instruments and Relays described elsewhere. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station. In addition, numerical relay shall have sufficient contacts and shall be configured for SAS operation. Intermediate auxiliary relay with sufficient spare contacts shall be used for controlling CB or any other switching devices through numerical relay in case of SAS operation.
b.) Status indicating discrepancy, Control switches for 33 kV Circuit Breaker with safety arrangements.
c.) Illuminated Circuit Breaker and Isolator position indicators.
d.) Signaling relays (annunciator, compact type) to yield audiovisual signals on faults and have reset feature.
e.) The inside of the panel will have all auxiliary relays to sense the operation of gas relays, over temperature, over current, differential relay operation failure of auxiliary voltage (DC & AC) etc. and to transmit for tripping and fault signaling.
f.) All inside equipment described and required shall be neatly arranged inside the panel.
g.) Thermostat control heater with status indicating illumination lamp (LED) shall be provided.
h.) The terminal blocks for connecting the incoming multi-core cables shall be placed at the bottom part and necessary glands/ opening shall be provided for the entry of the outside cables.
i.) Sufficient-working spaces shall be provided inside the panel between instruments and wiring for easy approach.

j.) All AC, DC auxiliary power circuits and PT secondary circuits entering the control panel shall be provided with MCCB. Separate MCBs shall be provided for DC supply to Power, Control and Alarm & Indication circuits.

k.) Provision to hang danger/ caution board.

l.) The PCM panel shall be SCADA/SAS compatible and hence all intelligent devices, digital energy meters etc. shall comply IEC61850. All physical connections for control, measurement and status indication shall be made SAS ready.

m.) Sufficient spare terminals (at least 10%) in each terminal block.

n.) Stabilizing resistance and Metrocil of appropriate value by calculation for the for the high impedance REF scheme in the PCM panel.

o.) There must be two trip coils, both trip coils shall be energized by separate contacts of trip relay for protection tripping. However, for manual tripping, only one trip coil can be engaged only.

p.) All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.

q.) Circuit Breaker control indicating switches and isolating position indicating lamps to indicate spring Charge/ Readiness for closing and healthy trip circuit indicating readiness for tripping.

r.) Signaling /indicating lamps shall be LED type only.

s.) Auxiliary relays, trip relays with spare contacts, fuses.

t.) All necessary switches etc. Local/remote switches shoild have atleast 4NO+4NC contact

u.) Provision for lighting etc.

v.) 70W, 230V AC, 1-phase heater with thermostat and control switch and a visible light indicator which indicate the "ON"- "OFF" position of the heater. Master trip auxiliary relay coil rating shall be 110Volt DC.

w.) Mimic diagram along with semaphore for CB, DS and ES. Mimic diagram shall contain LED based Semaphore Indicator instead of moving Semaphore indicator. The color and size of the mimic shall be as described below:

33 KV	GREEN	½" X 1/8"
11 KV	BLACK	½" X 1/8"

x.) Ferrule marking and color coding for all type of wiring shall be as follows:

1. **Ferrule marking:** Ferrule marking shall be done by white flexible rubber/ PVC tube with permanent black ink printing on top, fitted with cable, double point addressing (source-destination)
   - i. "A"- for differential protection circuit
   - ii. "C"- for O/C & E/F protection circuit
   - iii. "D"- for metering circuit
   - iv. "E"- for PT circuit
   - v. "L"- for Alarm & Indication circuit
   - vi. "S"- for fault recorder
2. **Color coding:**
   - i. "Black"- for phases of AC supply
   - ii. "White"- for neutral of AC supply
   - iii. "Grey"- for control circuit
   - iv. "Brown & Grey"- for (+) and (-) DC supply respectively
   - v. "Red, Yellow, Blue, Black"- for CT and PT circuit
   - vi. "Yellow with green strip"- for earthing

y.) Detailed schematic diagram of control circuit of PCM inside panel.

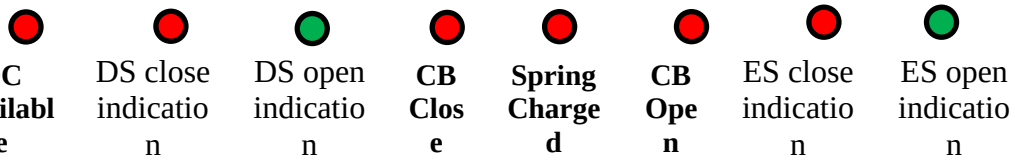
z.) Separate relay shall be used for over current, Earth fault protection and differential protection.

aa.) Annunciator shall have at least 14 nos. window for 33kV Incoming, Outgoing, Auxiliary Transformer & Bus Coupler panel and 30 nos. windows for 33kV Transformer panel
bb.) Necessary communication cable and software shall be supplied.

cc) Inter tripping arrangement for 11 kV incomer (from 33 kV transformer feeder tripping) and for 33 kV transformer feeder (from directional tripping of 11 kV incomer or Stand by E/F tripping) shall be provided. All type of tripping shall be done through Master Trip relay.

dd) Supply RTCC Panel with AVR relay and tap changing control switch along with necessary indication system (Tap position, temperature etc.).

ee) Following LED Indicators including Lamp test facility shall be provided in the panel:



Besides the provisions of control, signal, protection and metering described, any other provisions to suit with the requirement of associated equipment of the concern feeder shall be provided. All meters and relays shall be flush mounting. There shall be panel-grounding terminal.

The bidder shall quote the particulars of various protective relays, meters, Auxiliary relays signaling relays, discrepancy control and position indicating switches etc. of the control panel, mentioning the names of the manufacturers.

7.3.4.1 D Alarms

The following alarm provision shall be made:

1. **33 KV TRANSFORMER FEEDER (30 or more window Annunciator)**

Main DC Fail	**AC Fail**	**Main Relay-1 Faulty**	**Main Relay-2 Faulty**	**TCS-1 Unhealthy**	**TCS-2 Unhealthy**
PT Failure	**OTI High Alarm**	**OTI High Trip**	**WTI High Alarm**	**WTI High Trip**	**PRD Trip**
MT Buchholtz Alarm	**MT Buchholtz Trip**	**OLTC Surge Trip**	**O/C Trip**	**E/F Trip**	**87T Trip**
87N/64 Trip	**11 kV Inter trip**	**Main tank oil level high/low**	**Lockout operated pare**	**Trip relay-2 operated**	**OLTC out of step**
OLTC faulty/motor	**OLTC in max. position**	**OLTC in min. position**	**Spring Charge Fail**	**OLTC BZ Alarm**	**SCADA/ Remote**

tripped					**Trip**

2. **33 kV Incoming/Outgoing/Bus Coupler/Auxiliary Transformer Feeder (at least 14 window Annunciator)**

Main DC Fail	**AC Fail**	**Main Relay Faulty**	**PT Failure**
TCS-1 Unhealthy	**TCS-2 Unhealthy**	**O/C Trip**	**E/F Trip**
67 Trip	**67N Trip**	**Trip relay operated**	**Spare**
Spring Charge Fail	**SCADA/ Remote Trip**	**OV/UV Trip(Only for IN/OUT Panel)**	**Spare**

7.3.10 E TESTS

Complete tests shall be made at the manufacturer's factory in accordance with the latest relevant IEC 62271-200:2003 standards. Among others, at least the following test shall be included:

a) Wiring Check
b) Functional check
c) Di-electric Test
d) Verification of protection

Test plugs shall be supplied. Test results of instruments and relays are to be provided along with the bid.

7.3.4.1 F Construction Details

Each panel shall be fabricated from steel sheet (minimum 1.62 mm thick) with necessary steel member reinforcement to make the structure self supporting. All joints are to be welded and ground to be made smooth.

Mounting brackets required shall be arranged inside the panel for mounting and fixing auxiliary devices and terminal blocks.

Instruments meters control switches and protective relays shall be mounted on the front panel only. Panel output mounting studs and support brackets shall be accurately located.

Finished panel surface shall be free of waves and other imperfections exterior panel surfaces shall be send blasted, ground smooth, filled, panel and finished with gray enamel. Interior surface shall be sand blasted, primed and finished with glass white enamel.

The panel shall be designed to have bottom closed and with an adequate number of 50 mm knock outs provided to facilitate entry of control wires and cables. The back end closure of the panel shall be equipped with hinged formed door. The door shall be rigid and shall be equipped with three point latches.

The supplier shall furnish internal panel wiring and circuit protection. The supplier shall provide one 70W, 240, AC strip heater in the panel. The heater shall have a separate switch. Engraved name plate shall be provided at the top of the front enclosure.

7.3.4.1 G PANEL WIRING

The supplier shall provide internal wiring and connections, in accordance with the requirements of the following paragraph.

All wiring used within the panel shall conform to the requirements of these specifications and shall be installed and tested at the factory. All wiring shall be neatly and carefully installed in wring gutters of raceway wiring raceway shall be plastic wiring duct with covers. Instrument wiring on the panel shall be numbered sequentially from the sources to the panel instrument and the number of the source equipment shall be used as a prefix for the individual wire numbers, wiring shall be terminated at terminal blocks plainly lettered or marked in accordance with the manufacturer's connection diagrams.

Sufficient clearance shall be provided for all the leads. All the leads for external circuit wiring shall be connected to grounded terminal blocks located for convenient connection of external circuits.

Splices will not be permitted in panel wiring.

All the terminal block connections shall be made with ring type lugs. Pre-insulated ring type terminals with crimp guide or per-insulated slotted spring spade terminals shall be provided on devices equipped with individual fitted covers.

Arrangement of circuits on terminal block shall be such that all the connections for one circuit, plus any spare conductors, shall have terminal blocks adjacent to the split and shall be provided with wiring required to interconnect the split unit.

The size of the wiring used in the panel shall be conform to the following requirements:

a.) Ampere meter and current transformer circuit: 6 Sq.mm (RYB color code shall be used)
b.) All other wiring: 2.5 Sq.mm.

Closing circuit of the PCM panel shall have Interlocking mechanism with DS/ES switch. DC/AC supply of the 33 kV breaker panel shall be supervised through corresponding PCM panel. Single point grounding of the neutral of CT/PT circuits shall be ensured. It is always recommended that the neutral of CT/PT is grounded at the CT/PT junction box end. Ferrule marking and color coding shall be as per clause **"7.1.4.1 C 33 kV PCM Panel Features"**

7.3.4.1 **H POWER SUPPLY DISCONNECT**

Each panel mounted devices requiring AC or DC supply, shall have disconnecting devices from the power supply in the tripped or open condition.

The MCBs used in DC control circuit shall have a voltage rating 125 VDC and sufficient current rating as per use. The tumbler switch in the heater shall have the same rating.

Each S/S will be equipped generally with the following :

3 (Three) phase MCCB for incoming from Auxiliary transformers	- 1 (one) no.
MCCB for incoming DC for battery	- 1 (one) no.
MCCB for AC outgoing	- 10 (ten) nos.
MCCB for DC outgoing	- 10 (ten) nos.

The fuses shall be modular type with Bakelite frame and reinforced retaining clips.

7.3.4.1 I INDICATING LIGHTS

Indicating lights of LED type shall be have transparent glass lenses and appropriately sized resister. CB spring charged indication- Blue, Panel DC available indication- White, CB close indication- Red, CB open indication- Green, DS close indication- Red, DS open indication

Green, ES close indication- Red"ES open indication- Green. It is recommended to install the CB, DS & ES Open/close indicating LED lamps/semaphore in the mimic bus.

7.3.4.1 J TERMINAL BLOCKS

Terminal blocks shall provided with white marking strips, circuit designation by the supplier shall be inscribed on the marking strip with black print, terminals in a quantity of not less than 25 percent of the interconnected terminals in excess shall be provided on each terminal block for circuit modifications and for termination of all conductors in multi-conductor cable.

All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.

CT, PT, Control, Alarm etc. wiring shall be separately grouped or segregated.

All physical connections for control, measurement and status indication shall be made SAS ready hence Terminal Blocks shall be kept reserved if necessary.

Terminal block shall be grouped in each panel for easy accessibility unrestricted by interference from structural members and instruments. Sufficient spaces shall be provided on each side of each terminal block to allow an orderly arrangement of all the lead to be terminated on the block.

7.3.4.1 K INSTRUMENTS AND DEVICES

Indicating instruments shall be semi flush panel type with 1% percent accuracy class except for energy meters which shall be of 0.2. They shall be approximately 100 mm square with black 240 degree scales on a white back ground.

All AC instruments shall be designed for operation on 5A current transformers secondary and 110V (50 Hz) potential transformer secondary.

7.3.4.1 L TRIP RELAYS

Following shall be the main features of a high speed tripping relays:

All tripping relays shall be of the heavy duty type suitable for panel mounting and shall have operating coils which are rated sufficiently to operate in conjunction with series flag relays. If necessary, normally closed contacts in series with the relay operating coil, shall be delayed for a period which will allow series flag relays to operate satisfactorily. All other tripping contacts should be instantaneous i.e. no intentional time delay. The operating time shall not exceed 10 milliseconds at rated voltage. The operating range of the relay shall be from 70% to 120% of rated voltage. Electrical reset facilities shall be available for operation, from remote and supervisory controls. High speed tripping relays shall prevent closing of the associated circuit breakers until reset. Wherever the tripping relay contacts need to break the d.c. current, sufficiently rated magnetic blow out contacts or such approved means shall be used.

Trip Relay shall be of following types:

a. Self-reset type for O/C, E/F protection relay
b. Hand & Electrical reset type for Differential, REF and Transformer Self-protection
c. Operating Coil Voltage: 110 V DC (No series resistor allowed)
d. Shall have in built freewheeling diode.

7.3.4.1 M SUPERVISION RELAYS

7.3.4.1 M.1 **Trip Circuit and Protection Supply Supervision**

The trip circuit supervision function shall be a seperate relay and independent of control and protection unit provided in the switchgear. Trip circuit supervision relays shall be provided to monitor each of the trip circuits of all 33kV circuit breakers and each relay shall have sufficient contacts for visual/audible alarm and indication purposes. The trip circuit supervision scheme shall provide continuous supervision of the trip circuits of the circuit breaker in either the open or closed position and independent of local or remote selection at the local operating position. Relay elements shall be delayed on drop-off to prevent false alarms during faults on dc wiring on adjacent circuits, or due to operation of a trip relay contact. Series resistances shall be provided in trip supervision circuits to prevent mal tripping a circuit breaker if a relay element is short circuited. Relay alarm elements shall be equipped with hand resetting flag indicators.

Trip circuit supervision relay (TCSR) shall supervise not only the trip coil but also the whole trip circuit during both breaker open and close position (pre-close & post-close). Both trip circuits shall be supervised by separate TCS relay. TCS function of main relay shall be avoided for supervision.
All the TCS relay shall have at least 3NO+3NC contact for Indication, Annunciation & SAS Integration. 2 NO contact shall be used for CB closing circuit interlock & closing readiness indication (if used) and 2 NC contact shall be used for TCS faulty Annunciation & SAS integration.

7.3.4.1 M.2 D.C. Supply Supervision

All the DC Supply MCB (Main supply, Control supply, Device supply, Indication supply, Annunciation supply etc.) shall have at least 2NO+2NC contact for & there shall be 1 (one) 110V D.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main DC supply entry point at terminal block with inscription "Main D.C. Supply Supervision relay" and shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration. These supervision relays are to be independent of alarms from the trip circuit supervision scheme so that the operator can clearly differentiate via the available alarms between loss of supply due to a blown fuse / tripped MCB and failure of a trip circuit's supervision /faulty supervision wiring. 1 NO contact of the Main DC supply supervision relay & DC supply MCBs shall be used for DC supply healthy indication (if used) and 2 NC contact shall be used for DC supply faulty Annunciation & SAS integration

DC supply supervision of the annunciation circuit shall be performed by the built in AC/DC fail relay of the Annunciator. Hence, the Annunciator shall be powered by dual source (with internal/external AC/DC changeover switch).

7.3.4.1 M.3 PT Supply Supervision

Each PT supply secondary circuit shall be supervised by individual 110V A.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main PT supply entry point at terminal block with inscription "Measuring/Protection P.T. Supply Supervision relay" with at least 2NO+2NC contact for Indication, Annunciation & SAS integration. 1 NO contact of the PT supply supervision relay & PT secondary supply MCBs shall be used for PT supply healthy indication (if used) and 2 NC contact shall be used for PT supply faulty Annunciation & SAS integration.

7.3.4.1 M.4 A.C. Supply Supervision

There shall be 1 (one) 240V A.C. operated no-volt auxiliary relay (self-reset type) installed across panel's main AC supply entry point at terminal block with inscription "Main A.C. Supply Supervision relay" and shall have at least 2NO+2NC contact for Indication, Annunciation & SAS integration.
All the AC Supply MCBs (Main supply, Spring charge motor supply, TPS motor supply, lighting & heating supply etc.) shall have at least 2NO+2NC contact for Indication, Annunciation & SAS

integration. 1 NO contact of the Main AC supply supervision relay & AC supply MCBs shall be used for AC supply healthy indication (if used) and 2 NC contact shall be used for AC supply faulty Annunciation & SAS integration.

7.3.4.1 N SPECIFICATION OF 110V, 3 x 5(6) A, 3-PHASE, 4-WIRE, 3-ELEMENT, INDOOR TYPE MULTI-TARIFF PROGRAMMABLE METER WITH ASSOCIATED INSTRUMENT TRANSFORMERS ENCLOSED IN METERING PANEL.

7.3.4.1.N. A GENERAL

The meters are required for the purpose of energy metering of medium/high/extra-high voltage consumer metering at 132 kV or 33 kV or 11kV level. KWh is the unit for the purpose.

System voltage	Nominal service voltage 110V (PT Secondary), 3 phase 4wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	50 Hz

7.3.4.1.N. B SPECIFICATION OF 110V 3 x 5(6)A, 3-PHASE, 4-WIRE 3-ELEMENT, INDOOR TYPE MULTI TARIFF PROGRAMMABLE DIGITAL ENERGY METER

The consumer meters are required for the purpose of energy metering of low voltage consumer who purchases power at 11 kV/33 kV line through PT & CT. kWh is the unit for revenue purpose.

System voltage	:	Nominal service voltage 110V, 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	:	50 Hz
Standard	:	The Energy Meter should be designed, manufactured and tested in accordance with IEC 62052-11, 62053-22 and 62053-23 or ANSI C 12.16, 12.10 (latest publication) or specified in this specification
Installation	:	Indoor Type
Type	:	Solid state.
Application	:	Registration of KWh (Peak & off-peak), Total KVarh(Q1+Q4), KW on 3- phase, 4-wire supply for balanced & unbalanced load (unidirectional). Peak 17.00-23.00. hrs and off peak 23.00-17.00 hrs (programmable) Bangladesh standard time. The software for Time of Use (TOU) shall be so developed to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
Connection	:	3-phase 4-wire, solidly grounded neutral.
Nos. of element	:	3 (Three)
Rated current	:	Basic current 5 amps and maximum current ≥6 amps.
Multiplication factor	:	The following shall be inscribe on the mater. Dial reading X CT ratio X PT ratio = Actual reading in KWh.
Register	:	Solid state LCD display type register. The display shall be programmable, automatic and include: • Meter ID • Time & date • Cumulative KWh (Peak & off-peak) • Cumulative Total KVarh (Q1+Q4) • Maximum demand (KW) with time & date • Cumulative Maximum demand (kW) for billing month.

Maximum demand (MD) in kW shall be registered using the technique of cumulating on integration period controlled by built-in process and the MD shall be continuously recorded and the highest shall be indicated. The highest MD shall be added to the cumulative store, which shall be automatically initiated after an interval of one month / one billing period by means of built-in timing device.

- Integration period: 30 (thirty) minutes.
- Number of MD reset (Automatic& manually).
- Average PF for billing period.

Instantaneous:

- Phase voltage with indication
- Phase amps with direction.
- Power factor (average).
- Demand (KW)
- Voltage phase angel (each phase) | or P.F. Angle(each phase)
- Current phase angle(each phase)
- Tampering indication in the register.

Memory storage : The meter shall have sufficient capacity (minimum 400 KB) to store the following readings and data in non-volatile memory even in case of power failure.

- Equipment identification codes, security codes and access codes.
- Number of power interruption with date & time (minimum 100 events).
- Latest power failure time & date
- Date & time of meter tempering. (Voltage & Current missing, demand reset , time change).
- Event logs
- Current & Previous registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4)
- Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence.

The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 180 (one hundred eighty) days.

- Load Profile data [kWh, KVarh (Q1+Q4)
- Phase voltage or Vh
- Phase amps or Ah

Accuracy class : Accuracy class is 0.2s (point two s) for active energy (KWh) & 0.5s for reactive energy (Kvarh)

Number of digit Minimum 5 (Five) integer with 3 (three) decimal (Total 8 digit).

Type of Display Solid-state LCD display.

Time switch : The time switch shall be built-in type and shall be designed to perform a present cycle of operation. Time switch shall reset MDI at the end of every month (billing period) automatically. In the event of failure of power supply and battery, at the same time set memory shall not be lost i.e. the set program shall be recorded in non-volatile memory. The maximum error shall be kept within ± 1 (one) second per day. Time error adjustment facility shall be provided.

Battery reserve : Each time switch must be provided with lithium battery which allow the switch to function for a period of not less than 10 (ten) years. The guaranteed life of the battery should not be less than 10 (ten) years and shall have provision for easy replacement. The shelf life of the battery should be minimum 15(fifteen) years or more.

Construction : The meter shall be completely self-contain round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic

/phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to accommodate both padlock and wire type seal.

IEC meters shall be minimum IP51. The ANSI Standard meter shall be effectively sealed to prevent entrance of rain and dust into its internal parts. The meter shall pass Rain test described in underwriter's laboratory standard UL-50 (USA) for type 3 enclosures. A general purpose finish of class 1 as specified in section 7 of ANSI C12.10 shall be provided for the meter and it shall meet the requirement of weather simulation test (Sec. 7.2.1 of ANSI C12.10) and salt spray test (ASTM B117). It shall be designed to operate continuously for the normal life of the meter in unsheltered outdoor tropical location exposed to the elements without corrosion or other damage to parts to adversely affect meter accuracy or reliability.

Enclosure for IEC Standard Meter

The meter shall be surface mounted in PCM panel with necessary wiring. The enclosure box should be made either of high quality flame retardant ABS Resin of minimum 3 mm thickness or of galvanized sheet steel of minimum 1.22 mm (18 SWG) thickness or of auto extinguishable, shockproof and UV resistant, hot molded glass reinforced polyester of minimum 3 mm thickness. The box shall have hinged front door with one toughened glass window or transparent UV resistant Polly carbonate to enable easy reading of meter. The metering box shall be weather proof, dust proof, rodent and inspect proof in accordance with enclosure classification IP54. Service cable entry and exit will be sides of the box and 40 (forty) mm diameter hole with black PVC conic cable gland shall be provided for side entry & exit for this purpose. All material parts shall have anti-corrosive protection.

All materials shall be designed, manufactured and tested as per IEC or equivalent International standards except as mentioned. The front door shall be removable and provision must be made for sealing in the closed position.

Socket : Meter sockets shall be suitable for installation of offered type meter. Meter sockets shall be 3-phase, 4-wire wye, 600 volt class, made from 16 gauge sheet metal. Meter sockets shall be similar except as described below. Meter sockets shall approximately 14″ (35.6 cm) H×9″(22.9cm) W×4″ (10.2 cm) D and rectangular in shape. Sockets shall be the same size as 1-phase sockets and terminal blocks shall be interchangeable. Sockets shall be ring less type, sealing latch to be stainless steel and have adequate means for socket grounding. Meter socket shall have a 2″(5 cm) Diameter top opening complete with a 1- ¼″ (3.2 cm) hub. Meter socket shall have 4 knockouts with a range up to 2″(5 cm) Diameter, one on the back, one in the bottom and one in each side. Meter socket shall comply with ANSI C 12.6, 12.10

The Socket shall have written permanently (not in paper printed) "connection diagram" distinctly marked in addition to all standard

data.

Terminal	:	Socket connected type/ Non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.
Connection	:	3-phase, 4-wire solidly grounded neutral.
Service life of meter	:	Shall be minimum 15 (fifteen) years.
Visual indication of operation	:	Pulse indicator on the front of meter as per meter constant.
Special condition	:	a) The factory calibration conforms to relevant IEC or equivalent international standard. LCD display shall be shown consecutively and continuously one after another. The display shall be automated i.e. no external means shall be required to see the display. Each display shall last for at least 5 (five) sec. b) Meter Electronic Circuit biasing voltage shall have to be ensured from each phase to phase and each phase to neutral and minimum basing voltage 40V.
Meter Sealing	:	The Energy meter body will be hermetically sealed or ultrasonically welded to avoid unauthorized opening of meter cover.
Communication port	:	The meter must be provided with a suitable communication port to allow down loading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard.
Remote Communication	:	The meter shall be equipped with external GSM-GPRS Modem, which will be able to interface with RS232, RS485 for data communication with the central server from meters, having all accessories like power supply adapter, necessary connecting cables, antenna with minimum 2.5 meter extension cable, connectors, enclosure box with fixing materials etc. The modem shall be compatible with existing AMR system of BPDB.

7.3.4.1.N.C TAMPER AND FRAUD PROTECTION FEATURE:

The meter shall have the following features to prevent/detect tamper and fraud:

- **Phase Sequence Reversal:** The meter should work accurately irrespective of phase sequence of supply.
- **Missing Potentials:** The meter shall be capable of detection occurrence of missing potential of one phase or two phase(s), which can happen due to intentional/accidental disconnection of potential link(s).
- **Terminal cover** must have micro-switch provision to monitor unauthorized opening. Opening of terminal cover shall trigger an event to be recorded in the event log memory.
- **Software Access:** Software access for configuration and setting of the meters.

7.3.4.1.N.D TECHNICAL FEATURE

- The body cover and socket / enclosure shall be provided security sealing provisions to prevent unauthorized access to the internal meter works.

- The meter shall be provided with connection diagram.
- The data access should be protected by minimum 3(three) steps software password in meter.
- The meter shall have provision of phase to phase and each phase to neutral biasing.
- The meter shall have minimum biasing voltage of 40V.
- The meter and socket/enclosure shall have provision of earthing.
- Meter must operate and accurately register demand and energy when service voltage is applied across any two of the three input terminals or when service voltage is applied from any input terminal to neutral. Meter will continue to operate even the neutral is missing.
- The meter and socket/ enclosure must be the same country of origin other wise the bid will be rejected.
- The registration of KWh (Peak & off-peak) on 3-phase, 4-wire supply for balanced & unbalanced load will be unidirectional. i.e. if one, two or three phase supply is/are reversed, it will take the absolute (kWh-del) + absolute (kWh-rev) and will add them together as total 3-phase KWh.
- The meter shall be equipped with remote GSM & PSTN communication option.
- It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850
- The meter shall have permanently print nameplate distinctly marked with the following in addition to all standard data:
    1. The word "BPDB" and insignia of BPDB.
    2. Voltage and current rating.
    3. Frequency.
    4. Number of element, number of wire and multiplication factor.
    5. Accuracy class.
    6. Year of manufacture.
    7. Serial number.
    8. Name of manufacturer.
    9. Meter constant.

7.3.4.1. N. E Display of measured values/ Meter Display

- The Sequence of LCD display should be user programmable.
- The contrast setting of LCD display should be visible in different lighting environment and distinctly visible in broad daylight.
- The meter should be of displaying time and date, the direction of energy i.e. as import/export or +/-, active tariff and internal fault indicators.
- There should be up to three groups of display to priorities the display. Each showing a programmable function group.

7.3.4.1.N. F Meter Parameterisation Software

- The parameterisation software must run on Windows operating environment.
- The software must be protected by software keys to control duplication and installation.
- The software should have a customizable printing feature by task list.
- The meter must be able to display or record meter ID, Program, Programmer ID, C. T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase (voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 8(eight) Channels data stored in different interval for 90 days.
- Tamper feature: The meter must have Errors & Warnings codes, History log and Event log(minimum 400events) to record date & time of all power outages, demand resets, time change.

- In addition, each software key must bear a unique user ID and that is not transferable to another PC that has different user ID.
- The Meter should be able to display the phasor diagram.
- The software for Time of Use (TOU) shall be compatible to accommodate future tariff and can be customized, if the purchaser changes the tariff .The software shall be compatible with Windows operating system.
- The Meter must be provided with meter passwords to secure communication between meter software and meter having minimum 3(three) access levels.
- The AMR Software have to be compatible with BPDB's existing AMR System. The Tenderer have to develop the total AMR System with exiting and supplied AMR Solution. In this case the tenderer have to provide their meter protocols so that all exiting meters and supplied meters data will be downloaded and managed in a single AMR System.

7.3.4.1.N. G EXTERNAL MODEM WITH ACCESSORIES

GSM/GPRS modem with RS-232/RS-485 ports, meter interfaced power supply, connection cables, antenna with minimum 2.5 meters cable, mounting facilities, enclosure (if necessary). The modems will be capable of GSM and GPRS connectivity simultaneously. For GSm configuration the AT command will be available and for GPRS communication the APN, reset time, username, password, port number, etc. are configurable. The modem will have the following specification.

Interruption (< 1 ms), RS-232 (at least 1), GPRS class 10, operating band 900/1800, auto reset capability (with phone call, SMS). The modem will be robust, durable and compatible with the employers existing service condition.

7.3.4.1.N. H Manufacturer

All the energy meter shall be supplied from any of the following Country: -

a) European Country.
b) North American Country.
c) Japan
d) Australia

The tenderer should submit authentic document with the tender against the country and location of the offered Electric Energy Meter Manufacturing plant which will be verified during tender evaluation.

Note: Related software & accessories if required for Energymeters is within the scope of supply.

7.3.4.1**.O PROTECTIVE RELAYS**

All Protective relays shall be numerical programmable type and shall comply relevant IEC or equivalent international standard. Contract arrangement of the relays should conform to the requirements of the diagram. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station.

All the protective relays shall be supplied from any of following manufacturers:

ABB (Switzerland/Finland/Sweden)/
Siemens (Germany/ Switzerland)/
Alstom (France/UK)/
Schneider (france/UK)/

NR, China/
SEL, USA.

Note: Related software & accessories if required for Relays is within the scope of supply.

7.3.4.1.**P. AUXILIARY RELAY**

Auxiliary relays with sufficient contact shall be used for transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank. etc.). Apart from these relays, each 33 kV PCM Cubicle shall be provided with 1 (one) set separate Auxiliary and signaling relay and wiring with fuses. This relay shall be used for control & monitoring of CB, DS and ES through numerical relay/BCU in case of SAS operation.

7.3.4.1.**Q. ANNUNCIATOR**

Each PCM panel shall be equipped with 1 (one) set Annunciator with sufficient windows (LED type with blinking facility) to display the alarms as per requirement. Annunciator shall have built in buzzer and AC/DC fail relay and shall be powered by dual source (with internal/external AC/DC changeover switch). Buttons for Accept, Mute, Test, Reset etc. shall be provided in the Annunciator.

7.3.4.1.**R. INDICATING AMMETERS**

Each 33 KV PCM Cubicle will be provided with 3 Ammeters (1 for each phase), analogue type.

7.3.4.1.**S. INDICATING VOLTMETERS**

1 (one) voltmeter with a multi-selector switch (phase to phase, phase to neutral, off) shall be installed on 33 KV transformer panel.

7.3.4.1.**T. MIMIC BUS**

LED based Semaphore Indicator showing the position (open/close) of Circuit Breaker, Isolator and Earth Switch shall be inserted within the mimic bus.

Mimic bus material shall be brass, bronze or copper with enamel finished or anodized aluminum or plastic. The mimic bus and included symbols shall be shaped, colored and located as international standard. Light indicator showing position (opening/closing) of circuit breaker shall be installed.

The mimic bus shall be attached to the panel by mechanical devices, not with adhesive. Attachment shall be closely spaced to hold all parts of the mimic bus firmly to the panel face.

Mimic bus shall be provided with the following dimensions and color code:

Voltage	Bus Color	Thick	Dimension (mm)
33 KV	Green	3	12

Note : One set of relay testing plug shall be supplied with protection, metering and control panel which will be included in the quoted price. Each cubicle shall be complete according to the specification, features and bill of materials but not limited to these items; the cubicles should be complete in all respects, to make it operational. 33kV bus name (1,2,3,4……) shall be indicated with visible permanent sticker in the 33kV mimic bus

7.3.4.1. U AVR Relay

Remote Tap Changer Cubicle (RTCC) Panel shall be equipped with AVR relay for automatic OLTC operation. It shall have provisions of auto/manual tap lower/rise operation and master/follower control function to facilitate parallel operation of transformers and appropriate data communication port have to be provided. AVR relay shall have IEC 61850-communication protocol for SAS.

7.3.4.1.U INFORMATION REQUIRED

The Tenderer/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information/Documents has to be submitted along with the tender:-

(a) Manufacturer's drawing showing Outline dimension & General arrangement drawings of offered type equipment.
(b) Manufacturer's Printed Catalogue describing specification and technical data of the offered type equipment.
(c) The Tenderer/Manufacturer shall submit with the bid the testing procedure & list of testing/measuring equipment, meters etc. used for Factory test witness.
(d) Construction, Installation, Operation & Maintenance Manual.
(e) Manufacturer's valid ISO Certificate.

7.3.4.1. V TESTS AT MANUFACTURERS WORKS FOR PCM PANEL

General

Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests.

MATERIAL TESTS

The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

TYPE TEST

Type tests are required to prove the general design of the offered equipments/ materials. The Tenderer shall submit the type test reports of the offered equipments/ materials from as per relevant clause.

ROUTINE TESTS

All equipments/ materials shall be subjected to routine tests as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract at the manufacturers works and shall include, but not be limited to, an operational test.

7.3.5 TECHNICAL SPECIFICATIONS & REQUIREMENTS OF 11KV VACUUM CIRCUIT BREAKERS WITH PROTECTION, CONTROL & METERING CUBICLES: (Not Applicable)

7.3.6 TECHNICAL SPECIFICATION OF 33KV ISOLATOR WITH EARTH BLADE

7.3.6.1 General Specification:

1.	Installation	Outdoor Sub-station
2.	Type	Air
3.	Construction	Open
4.	Operation	Gang
5.	Operating Mechanism	Manual
6.	Mounting Position	Vertical on Supporting Structure
7.	Number of Pole	3 (Three)
8.	Frequency	50 Hz
9.	System Nominal Voltage	33 kV
10.	System Maximum Voltage	36 kV
11.	Basic Insulation Level	170 kV
12.	Rated Normal Current	**1600/2500 A**
13.	Rated Short Time Withstand Current	40 kA (3 Sec.) for 2500 A , 31.5 kA(3 Sec.) for 1600 A
14.	Rated Power frequency withstand voltage (kVrms), 1 min	70 kV
15.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. Features

1) The isolators shall be single break Pattern [Vertical break or Horizontal break (centre break)] off-load type with manual operating mechanism for the earth blade. There shall be interlocking arrangement with the breaker to ensure that the Isolator can only be operated with breaker in "OFF" position. Necessary controls, accessories and auxiliary operating mechanism for manual operation shall be provided in water proof outdoor boxes.

2) The earthing device shall be gang operated & integral with the switch. The unit shall be complete with channel type mounting base, insulators, and phases coupling tube for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.

3) Auxiliary switch operated by the phase coupling tube shall be provided to control circuits for operating devices like indicators/alarms & interlocking with 10% spare contacts.

4) Terminal connectors shall be suitable for ACSR Dog/Merlin/ Gross Beak/ HAWK conductor as required.

5) Earthing steel pads shall be provided with provision of earth leads.

6) Cable glands for multi-core control/ power cables as required.

7) There shall be provisions for pad locking in "ON" & "OFF" position.

8) Provision of key interlocking.

9) Mechanical interlocking between earthing device & the switch shall be provided.

10) All accessories, nuts, bolts etc. required for mounting the isolator on structure as required.

11) All ferrous parts shall be hot dip galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.

12) All control devices shall be suitable for operation from 110 Volts DC available in the control room.

13) Operating mechanism shall be fully tropicalized and housed in waterproof housing.

14) Complete supporting steel structure.

15) Isolator and earthing devices shall be accordance with IEC-129. They shall be complete with supporting steelwork and installed to permit maintenance of any section of the sub-station plat when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.

16) The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 percent of the specified impulse insulation rating to earth.

17) Isolating switches shall be designed for live operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer magnetizing currents main contacts shall be of the high-pressure line type and acing contacts.

18) All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator can not be closed at the same time.

19) Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be un-effected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

B. Blades:

All metal parts shall be of non rusting and non corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts

shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

C. Base:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

D. Supporting Structure

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

E. Test Certificates:

The following test certificate along with test results for offered type Isolator confirming to the tender document shall be submitted with the offer from internationally reputed Independent testing laboratory or reputed & renowned testing laboratory as per relevant IEC Standard, otherwise the bid will be rejected.

a) Short time & peak withstand current.
b) Resistance measurement of the main circuit.
c) Temperature rise.
d) Lightning Impulse Voltage withstand.
e) Dielectric test
f) Operating and mechanical endurance test
g) verification of the protection
h) Operation at the temperature limits

F. Information Required

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer’s Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.3.7 TECHNICAL SPECIFICATION OF 33KV ISOLATOR WITHOUT EARTH BLADE

7.3.7.1 General Specification:

1.	Installation	Outdoor Sub-station
2.	Type	Air
3.	Construction	Open
4.	Operation	Gang
5.	Operating Mechanism	Manual
6.	Mounting Position	Vertical on Supporting Structure
7.	Number of Pole	3 (Three)
8.	Frequency	50 Hz
9.	System Nominal Voltage	33 kV
10.	System Maximum Voltage	36 kV
11.	Basic Insulation Level	170 kV
12.	Rated Normal Current	**1600/2500 A**
13.	Rated Short Time Withstand Current	40 kA (3 Sec.) for 2500 A , 31.5 kA(3 Sec.) for 1600 A
14.	Rated Power frequency withstand voltage (kVrms), 1 min	70 kV
15.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. Features

1) The isolators shall be single break Pattern [Vertical break or Horizontal break (centre break)] off-load type with manual operating mechanism for the earth blade. There shall be interlocking arrangement with the breaker to ensure that the Isolator can only be operated with breaker in “OFF” position. Necessary controls, accessories and auxiliary operating mechanism for manual operation shall be provided in water proof outdoor boxes.

2) The earthing device shall be gang operated & integral with the switch. The unit shall be complete with channel type mounting base, insulators, and phases coupling tube for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.

3) Auxiliary switch operated by the phase coupling tube shall be provided to control circuits for operating devices like indicators/alarms & interlocking with 10% spare contacts.

4) Terminal connectors shall be suitable for ACSR Dog/Merlin/ Gross Beak/ HAWK conductor as required.

5) Earthing steel pads shall be provided with provision of earth leads.

6) Cable glands for multi-core control/ power cables as required.

7) There shall be provisions for pad locking in “ON” & “OFF” position.

8) Provision of key interlocking.

9) Mechanical interlocking between earthing device & the switch shall be provided.
10) All accessories, nuts, bolts etc. required for mounting the isolator on structure as required.

11) All ferrous parts shall be hot dip galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.

12) All control devices shall be suitable for operation from 110 Volts DC available in the control room.

13) Operating mechanism shall be fully tropicalized and housed in waterproof housing.

14) Complete supporting steel structure.

15) Isolator and earthing devices shall be accordance with IEC-129. They shall be complete with supporting steelwork and installed to permit maintenance of any section of the sub-station plat when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.

16) The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 percent of the specified impulse insulation rating to earth.

17) Isolating switches shall be designed for live operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer magnetizing currents main contacts shall be of the high-pressure line type and acing contacts.

18) All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator can not be closed at the same time.

19) Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be un-effected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

B. Blades:

All metal parts shall be of non rusting and non corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts

shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

C. Base:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

D. Supporting Structure

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

E. Test Certificates:

The following test certificate along with test results for offered type Isolator confirming to the tender document shall be submitted with the offer from internationally reputed Independent testing laboratory or reputed & renowned testing laboratory as per relevant IEC Standard, otherwise the bid will be rejected.

i) Short time & peak withstand current.
j) Resistance measurement of the main circuit.
k) Temperature rise.
l) Lightning Impulse Voltage withstand.
m) Dielectric test
n) Operating and mechanical endurance test
o) verification of the protection
p) Operation at the temperature limits

F. Information Required

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.3.8 TECHNICAL SPECIFICATION OF 33 KV OFF-LOAD FUSED ISOLATOR FOR AUXILIARY TRANSFORMER AND BUS PT.

A. General :

1.	Installation	Outdoor
2.	Type	Air
3.	Construction	Open
4.	Operation	Gang
5.	Purpose	For auxiliary Transformer / Bus PT
6.	Operating Mechanism	Manual
7.	Base Mounting Position	Vertical
8.	Number of Pole	3 (Three)
9.	Frequency	50Hz
10.	System Nominal Voltage	33 kV
11.	System Maximum Voltage	36 kV
12.	Continuous Current	400 A
13.	Fuse Rating	5A
14.	Fuse Type	HRC Cartridge
15.	Rated Short Time Withstand Current	31.5KA 3 Sec.
16.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.
17.	Features - Single Break Pattern [Vertical break). - Channel type mounting base, insulator & phase coupling tube for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod. - Terminal connectors shall be suitable for ACSR Merlin/ Grosbeak/ HAWK conductor as required. - Glands for multi-core control cables. - Provision for pad locking in “ON” & “OFF” position. - Galvanized Nuts, bolts & all accessories shall be required for mounting the isolator on structure. - All ferrous parts shall be hot dipped galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90. - 2 sets of spare fuse links (6 Nos.) shall be supplied with each set of isolator. - All steel supporting structures for mounting on the structures. - For enclosed fuses a positive mechanical indication shall be provided to indicate a blown fuse. - The design shall provide reasonable protection against accidental earthing by animals or birds. - All the movable current carrying contacts shall be silver plated. - Arcing horn if the unit is combined. - Disconnecting blade has continuous current rating as specified.	

	- Isolating devices shall be accordance with IEC-129. They shall be complete with supporting steel work and installed to maintenance of any section of the sub-station plant when the remainder is alive and shall be so located that the minimum safety clearances are always maintained. - The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 percent of the specified impulse insulation rating to earth. - Isolating switches shall be designed for live operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer-magnetizing currents. Main contacts shall be of the high-pressure line type and arcing contacts, if provided, shall be to the Engineer's approval. - Service conditions require that isolating switches shall remain alive and in continuous service for periods of up to 2 years in the climatic conditions specified without operation or maintenance. These contacts shall carry their rated load and short circuit currents without over heating or welding and at the end of the two years period the maximum torque required at the operating handle to open 3-phase isolator shall not exceed 350 NM. - All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator con not be closed at the same time. - Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be un-effected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating - devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90. - At least two pairs of auxiliary contacts for each isolator shall be provided.

7.3.9 TECHNICAL SPECIFICATION OF 33 KV OFF-LOAD ISOLATOR WITHOUT EARTH BLADE.

7.3.9.1 General

1.	Installation	Outdoor
2.	Type	Air
3.	Construction	Open
4.	Operation	Gang
5.	Operating Mechanism	Manual
6.	Mounting Position	Vertical for Bus Isolator & Horizontal for Bus Coupler on supporting structure
7.	Number of Pole	3 (Three)
8.	Frequency	50 Hz
9.	System Nominal Voltage	33 kV
10.	System Maximum Voltage	36 kV
11.	Basic Insulation Level	170 kV
12.	Rated continuous Current	**1600/2500 A**
13.	Rated Short Time Withstand Current	40 kA (3 Sec.) for 2500 A , 31.5 kA(3 Sec.) for 1600 A
14.	Rated power frequency withstand voltage, kV (rms) 1 minute	70KV
15.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. Features

1) The isolators shall be single break Pattern [Vertical break or Horizontal break (centre break)] off-load type with manual operating mechanism for the earth blade. There shall be interlocking arrangement with the breaker to ensure that the Isolator can only be operated with breaker in "OFF" position. Necessary controls, accessories and auxiliary operating mechanism for manual operation shall be provided in water proof outdoor boxes.

2) The earthing device shall be gang operated & integral with the switch. The unit shall be complete with channel type mounting base, insulators, and phases coupling tube for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.

3) Auxiliary switch operated by the phase coupling tube shall be provided to control circuits for operating devices like indicators/alarms & interlocking with 10% spare contacts.

4) Terminal connectors shall be suitable for ACSR Dog/Merlin/ Gross Beak/ HAWK conductor as required.

5) Earthing steel pads shall be provided with provision of earth leads.

6) Cable glands for multi-core control/ power cables as required.

7) There shall be provisions for pad locking in "ON" & "OFF" position.

8) Provision of key interlocking.

9) Mechanical interlocking between earthing device & the switch shall be provided.

10) All accessories, nuts, bolts etc. required for mounting the isolator on structure as required.

11) All ferrous parts shall be hot dip galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.

12) All control devices shall be suitable for operation from 110 Volts DC available in the control room.

13) Operating mechanism shall be fully tropicalized and housed in waterproof housing.

14) Complete supporting steel structure.

15) Isolator and earthing devices shall be accordance with IEC-129. They shall be complete with supporting steelwork and installed to permit maintenance of any section of the sub-station plat when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.

16) The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 percent of the specified impulse insulation rating to earth.

17) Isolating switches shall be designed for live operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer magnetizing currents main contacts shall be of the high-pressure line type and acing contacts.

18) All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator can not be closed at the same time.

19) Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be un-effected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

B. Blades:

All metal parts shall be of non rusting and non corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any

part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

C. Base:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

D. Supporting Structure

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

E. Test Certificates:

The following test certificate along with test results for offered type Isolator confirming to the tender document shall be submitted with the offer from internationally reputed Independent testing laboratory or reputed & renowned testing laboratory as per relevant IEC Standard, otherwise the bid will be rejected.

q) Short time & peak withstand current.
r) Resistance measurement of the main circuit.
s) Temperature rise.
t) Lightning Impulse Voltage withstand.
u) Dielectric test
v) Operating and mechanical endurance test
w) verification of the protection
x) Operation at the temperature limits

F. Information Required

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.3.10 33KV CURRENT TRANSFORMER

A. GENERAL TECHNICAL PARTICULARS:

1.	Application	Metering and Protection

2.	Installation	Outdoor.
3.	Construction	Sealed Tank
4.	Insulation	Oil
5.	Number of Phase	Single
6.	Rated Frequency	50 Hz
7.	Mounting	On Supporting Structure
8.	System Primary Rated Voltage	33 kV Phase to Phase
9.	Maximum System Voltage	36kV Phase to Phase
10.	System Earthing	Effectively earthed
11.	Basic Insulation Level (1.2/50 μ sec.)	170 kV
12.	Power Frequency Withstand Voltage (1 min. 50 Hz).	70 kV
13.	33 kV Line Feeder Ratio:	600-1200/5-5A 1200-2400/5-5A
	Transformer Feeder Ratio:	**300-600/5-5-5A (Not Applicable)**
14.	Primary	Single Winding
15.	Secondary	Double Winding
16.	Accuracy Class	0.2S for Measurement, 5P20 for Protection.
17.	Burden	30VA
18.	Short Time Current Rating	40 kA for 1200-2400/5-5A, 31.5 kA for 3 Sec.
19.	Extended Current Rating	120% of Rated Current
20.	Over Current Rating	< 10 A
21.	Creepage Distance	25 mm/ KV (minimum)
22.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC 61869-1 & IEC 61869-2 standards.

B. FEATURES & ACCESSORIES:

a) Current transformer shall have porcelain outdoor type bushing.
b) Terminal connectors provided, shall be suitable for ACSR Merlin/ Grosbeak/ Hawk conductor as
required.
c) The equipment must be tropicalized and suitable for the outdoor location.
d) Galvanized nuts, bolts and all accessories required for mounting on structure.
e) All ferrous parts shall be hot-dip galvanized after completion of machining. Galvanizing shall be
in accordance with BS-729.
f) Each terminal shall have cadmium-plated nuts and bolts.
g) Sealing/locking arrangement for the secondary terminal box shall be provided.
h) Diagram plate and rating nameplate shall be provided. Rating plate and diagram plate shall be made of stainless steel and have engraved letters filled with blank enamel paint mentioning manufacturer's name, client name, year of manufacturing, contract no & model no, rating, etc.
i) Supporting clamps, all accessories shall be provided with the CT's for installation on supporting gantry structure for line feeders CT's.

C. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of **33KV Current Transformer**.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.3. 11 TECHNICAL SPECIFICATION OF SINGLE PHASE 33KV POTENTIAL TRANSFORMER

A GENERAL TECHNICAL PARTICULARS:

1.	Application	Metering and Protection
2.	Installation	Outdoor
3.	Insulation	Oil
4.	Type	Voltage Induction
5.	Construction	Oil Tank
6.	Number of Phase	Singe Phase (1Set=3Nos)
7.	Frequency	50 Hz
8.	Mounting Mounted	Supporting on Gantry Structure Mounted
9.	System Primary Rated Voltage	33 kV (Phase to Phase)
10.	System Primary Maximum Voltage	36 kV (Phase to Phase)
11.	System Earthlings	Effectively earthed
12.	Basic Insulation (Impulse withstand Voltage)	170 kV
13.	Power Frequency Withstand Voltage	70 kV
14.	The neutral end of primary winding, for direct connection to ground	Insulated to withstand the 10 kV low frequency test.
15.	Type of Secondary Winding	Double Winding
16.	Transformation Ratio	$(33/\sqrt{3})/ (0.11/\sqrt{3})/ (0.11/\sqrt{3})$ kV
17.	Creepage Distance	25 mm/ kV (minimum)
18.	Rated Secondary Burden	30 VA
19.	Voltage limit factor	1.2 continuous
20.	Class of Accuracy	0.2 for metering and 3P for protection.
21.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC IEC 61869-1 & IEC 61869-3.

B FEATURES & ACCESSORIES:

a) Potential transformer shall have porcelain outdoor type bushing.

b) Terminal connectors provided, shall be suitable for ACSR Merlin/ Grosbeak/ Hawk conductor as required.

c) The equipment must be tropicalized and suitable for the outdoor location.

d) Galvanized nuts, bolts and all accessories required for mounting on structure shall be provided.

e) All ferrous parts shall be hot dip galvanized after completion of machining, galvanizing shall be in accordance whether BS-729.

f) Each terminal shall have cadmium-plated nuts and bolts.

g) Each Voltage transformer is to be protected by high voltage fuse of the high rupturing capacity cartridge type. All fuses are to be clearly identified and easily accessible.

h) Diagram plate and rating nameplate shall be provided. Rating plate and diagram plate shall

be made of stainless steel and have engraved letters filled with blank enamel paint mentioning manufacturer's name, client name, year of manufacturing, contract no & model no, rating, etc.

i) Sealing/locking arrangement for the secondary terminal box shall be provided.

C INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of **33KV Potential Transformer**.
b) Outline and General Arrangement drawings.
c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.3.12 33 KV SINGLE PHASE LIGHTNING ARRESTER

1.1 SCOPE

This specification covers the general requirements of the design, manufacture, testing and inspection requirement of 33kV Outdoor Type Single Phase, Metal Oxide (ZnO), Gapless Lightning Arrester and accessories as specified.

1.2 GENERAL :

Lightning arresters shall protect substation and pole-mounted equipment from voltage impulses or surges resulting from lightning strokes, system faults, circuit switching, load rejection or other events. The arresters shall limit such over-voltages to voltage levels below equipment BIL ratings. The country of origin and place of manufacturer shall be same.

1.3 STANDARDS

Performance, Design & Testing of Outdoor Type Single Phase Metal Oxide (ZnO) Gapless Lightning Arrester shall conform to the latest edition of the IEC-60099-4 or equivalent international Standards unless otherwise specified herein.

1.4 SERVICE CONDITIONS

a. Altitude : 1000 meters above the sea level
b. Maximum ambient temperature : 48° C
c. Minimum ambient temperature : 3°C
d. Relative Humidity : 50-100%
e. Average annual rainfall : 3454 mm
f. No. of annual rainy days : 80-120 days
g. Isokeraunic level : 80-120 days/year
h. Pollution of ambient air : dust, salt, chemicals

1.5 SYSTEM PARTICULARS

SL. NO.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL
1.	Nominal System Voltage, KV (Voltage Class)	33
3.	Maximum System Voltage, KV	36
4.	System Frequency, Hz	50
5.	Type of System Grounding	Solidly earthed system
6.	Rated Fault Level (3-Phase Symmetrical), kA 1 sec.	31.5
7.	Lightning Impulse Withstand Level(LIWL), kV	170

1.6 TECHNICAL REQUIREMENTS

Lightning arrester shall have the following characteristics:

1	Application	Distribution Transformer/ Overhead Line/ Power Cable Line/ Power Transformer of heavy duty class.
2	Type of Arrester	Station Class, Metal Oxide (ZnO), Gapless
3	Construction	Single Unit, gapless hermetically sealed in with non-linear characteristics with high energy capacity, all enclosed in housing.
4	Installation	Outdoor
5	Mounting	Pole Mounted steel bracket/Gantry mounted
6	Rated Arrester Voltage (rms, Ur)	36kV
7	Continuous Operating Voltage (COV, Uc)	22- 27.5 kV
8	Number of Phase	1
9	Nominal Discharge Current (kAp) of 8/20 micro second wave	10 kA
10.1	Type of Lightning Arrester housing	Porcelain
10.2	Power Frequency withstands voltage of Lightning Arrester Housing, Dry & Wet.	≥ 70 kV (Dry & wet)
10.3	Impulse Withstand Voltage of Lightning	≥170 kV (peak)

	Arrester Housing.	
11	Lightning Impulse Residual Voltage (8/20 micro-second wave)	80 or better
12	Steep Current Impulse Residual Voltage at 10kA for 1 micro-second front time.	85 or better
13	High Current Impulse Withstand Value (4/10 micro-second)	100 or better
14	Minimum Energy Discharge capability (kJ/kVr) at rated voltage.	5
15	Line Discharge Class	3
16	Creepage distance (minimum)	31 mm/ kV
17	Partial Discharge (pico-coulomb) when energized at 1.05 times its continuous operating voltage.	Not exceeding 10 pC

1.7 BASIC FEATURES

1.7.1 CONSTRUCTION:

Lightning arresters shall be gapless type described briefly as follows:

a. Gap less Arresters shall have elements of zinc oxide to perform both the surge discharge and power frequency reseal functions**.** ZnO arrester shall have excellent thermal stability for high energy surges, external pollution & temporary over voltage. Zinc oxide elements block RMS value should be minimum 3kV.

1.7.2 INSULATORS

The housing insulator of Lightning Arrester shall be wet process porcelain. The insulator sheds shall be designed to minimize the trapping of contamination and shall have a high Creepage distance (minimum 31mm/kV) and a high dielectric strength, as specified in article 1.6 above. Also, the minimum aerial distance between contact terminal to ground shall be 25 inch (635mm) for 33kV.

1.7.3 CONNECTORS

The Line lead and earthing terminal with clamps shall be provided, suitable to accommodate AAC/ ACSR/ Copper Conductor of diameter from 10.0mm to 15 mm. - The necessary connecting wire (5meter for each LA) for the connection of each Lightening arrester to surge counter shall also be included in the scope of supply.

1.7.4 NAMEPLATE

Information required for identification must be embossed on a stainless steel nameplate firmly fixed to the arrester and shall include:

a. Arrester classification
b. Manufacturers identification or symbol
c. Arrester model and identification number
d. Arrester voltage rating
e. Year of manufacture
f. Contract Number.

1.7.5 SURGE COUNTER

Tenderer shall supply surge counter/Monitor for each phase of the surge arrester. It shall be integrated into the arrester ground connection and counts the surge arrester responses that have occurred. Surge counter with leakage current meter shall also offer monitoring of arrester leakage current. The surge counter shall be analog or digital type. Surge arrester shall have suitable earth terminal to connect surge counter with insulated cable. Surge counter shall be of at least 4 digit.

1.7.6 MOUNTING

For pole mounted Mounting steel bracket and fixing bolts, nut, washer, Standard clam etc. shall be provided with the arrester for steel cross-arm. The mounting steel bracket & necessary fittings shall be hot dip galvanized as per BS-729.

For structure mounted surge arrester, arrester shall be supplied with insulating base.

1.7.7 FINISH

All exposed steel or iron parts of the arrester except threaded parts smaller than 3 inch in diameter, shall be hot-dip galvanized in accordance with ASTM A153.

1.8 TESTS:

1.8.1 TYPE TEST CERTIFICATES:

Tenderer's shall include in their offer the following type tests report as prescribed in IEC60099-4 for offered type Lightning Arrester of same voltage class:

i. Insulation withstand test on the arrester housing.
ii. Residual voltage test.
    a. Step current impulse residual voltage test.
    b. Lightning impulse residual voltage test.
    c. Switching impulse residual voltage test.
iii. Long duration current impulse withstand test.
iv. Operation duty test.
    a. High-current impulse operating duty test.
    b. Switching surge operating duty test.
v. Short-circuit test.
vi. Internal partial discharge test.
vii. Bending moment test.
viii. Environmental test.
ix. Seal leak rate test.
x. Radio interference voltage (RIV) test.

1.8.2 ROUTINE TEST:

Manufacturer shall have all routine test facilities for arrester at their own manufacturing premises. The following routine tests shall be carried out on all the arresters as per IEC 60099-4 and the test reports shall be made available for the observation at the time of inspection.

i. Residual voltage test.
ii. Internal partial discharge test.
iii. Reference voltage test.
iv. Leak test.

1.8.3 SPECIAL TEST:

Following special tests shall be performed during Pre-Shipment Inspection & Post-Landing Inspection (if necessary).

a. Insulation resistance test :
   Insulation test result shall be more than 1GΩ.
b. Seal Test:
   The randomly selected samples as specified shall be sunk in the 1 (one) meter deep

water tank for minimum 4 (four) hours. After removing samples from the water tank, the insulation resistance test shall have to perform again. The insulation resistance test result shall not vary more than 10% before and after seal test. After completing this test the MCOV shall be applied on Arrester at least five times. In each time the result shall be satisfactory as per specification.

1.9 DOCUMENTATION:

The following documents must be submitted along with the tender, without which the tender shall be considered as non-responsive.

1.9.1 Filled up Guaranteed Technical Particular (GTP) of the offered equipments.

1.9.2 Manufacturer's Production capacity as mentioned in Tender Data Sheet (TDS) of tender document.

1.9.3 Outline drawings and internal construction of offered equipment (including surge counter) considering the conceptual arrangement and nomenclature of a 33kV Lightning Arrester.

1.9.3.a At least 02(two) nos. of Manufacturer's Supply Experience for similar type Lightning Arrester of same voltage class within the last 5 (Five) years; years counting backward from the date of publication of Invitation for Tender (IFT) in the newspaper. The Supply Experience covering at least 25% of the Tendered quantity in a single Contract will be considered only.

Manufacturer's supply experience (supported by copy of Contract Agreement and Certificate from purchaser) shall be furnished in the following format:

Sl. No.	Name, Address, Phone No. E-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of material with Quantity	Date of completion of supply
1.					
2.					

1.9.3.b At least 02 (Two) nos. of Manufacturer's Satisfactory Performance Certificates (supported by the supply record) from Electricity Utility as End User depicting that similar type Lightning Arrester of same voltage class has been supplied within last 10 (ten) years; years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 02 (two) year. The Satisfactory Performance Certificate(s) shall be in End User's official pad in English and shall contain End User's full mailing address, e-mail address, website address, fax/telephone number for the convenience of authentication.

1.9.3.c The following provision will be applicable for purchasing less or equal to 5000 (five thousand) nos. of Lightning Arrester from new local manufacturers: **Not Applicable**

i. At least 02(two) nos. of Manufacturer's Supply Experience for similar type Lightning Arrester of same voltage class within the last5 (Five) years; years counting backward from the date of publication of Invitation for Tender (IFT) in the newspaper. The Supply Experience covering at least 5% of the Tendered quantity in a single Contract will be considered only.

Manufacturer's supply experience (supported by copy of Contract Agreement/ Work Order /Certificate from purchaser) shall be furnished in the following format:

Sl. No.	Name, Address, Phone No. E-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of material with Quantity	Date of completion of supply
1.					
2.					

ii. At least 02 (Two) nos. of Manufacturer's Satisfactory Performance Certificates (supported by the supply record) from public/private organization as End User depicting that similar type Lightning Arrester of same voltage class has been supplied within last 05 (five) years; years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 01 (one) year. The Satisfactory Performance Certificate(s) shall be in End User's official pad and shall contain End User's full mailing address, e-mail address, website address, fax/telephone number for the convenience of authentication.

iii. The New Manufacturer shall submit the following document with the Tender document:

a) Location of the Factory & layout plan.
b) List of Capital Machineries (Related to manufacturer of the Tendered goods).
c) Factory Project Profile
d) Production Line description.
e) List of Key Personnel (with Bio-data).
f) Source of raw materials.
g) Sample of offered item.
h) Testing facilities & calibration certificates of testing equipments.

iv. New Local Manufacturer's factory/manufacturing plant shall be visited & inspected by the Tender Evaluation Committee (TEC) and/or TEC nominated members, to assess the New Manufacturer's production capability and will submit a report regarding Technical and Financial aspect in comparison to the information and document furnished by Tenderer. If the assessment report is not satisfactory, the related tender proposal of the tenderer will be considered as Non-Responsive.

All costs regarding visiting & inspection shall be borne by the New Manufacturer.

Factory shall be inspected by Tender Evaluation Committee (TEC) and/or TEC nominated members as per following guide lines:

1. Location of the Factory & layout plan.
2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
3. Factory Project Profile
4. Production Capacity (Yearly)
5. Production Line description.
6. List of Key Personnel (with Bio-data)
7. Testing Facilities as per IEC60099-4 or latest revision there on.
8. Source of raw materials.
9. Provide sample of the Tendered product manufactured in the Factory for testing during factory Inspection.
10. Testing of offered type Lightning Arrester and ZnO shall be witnessed at manufacturer's testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.9.4.a&1.9.4.b) shall be applicable for tender Submission and Evaluation.

1.9.4 Type test report as per clause no. 1.8.1 for offered type Lightning Arrester of same voltage class as per IEC 60099-4. All Type Test shall be done from any of the following independent testing laboratories:

I. CESI, Italy
II. ESEF ASEFA, France
III. JSTC Japan
IV. KEMA, The Netherlands
V. PEHLA, Germany
VI. TUV Rheinland, Germany
VII. SATS, Norway
VIII. STLNA, USA
IX. VEIKI, Hungary
X. ZKU, Czech Republic
XI. UL, USA

1.10 Packing:

The complete Machines are to be export-packed and properly protected for shipment, rough transportation and storage. Specific care shall be taken for protection in store and reference is made to the climatic condition prevailing in Bangladesh. The packing used for equipment shall be 100% waterproof.

The supplier shall be responsible for damages due to inadequate packing. A packing list showing the contents of each packing shall be enclosed in a waterproof envelope secured to the outside of the packing case. A copy of the packing list shall also be enclosed inside the package.

All packages imported are liable to be opened for Customs examination and packing shall therefore be designed to facilitate opening and re-packing thereafter.

A red band (20 cm. wide) shall be painted all around each package. Each package shall have the following information printed on it in bold letters:

- Name of supplier.
- Port of Loading.
- Port of destination.
- Name of Consignee.
- Contract Number.
- Brief description of Stores.
- Number of Packages.
- Gross and net weight.
- Measurements.

In addition, each package shall be clearly marked or stencilled in red on two sides, the shipping mark, "Name of Utility, Bangladesh" inscribed within a triangle mark as shown below:
The Shipping Mark

UTILITY'S LOGO
BANGLADESH

On the other two sides arrow marking with the wording "THIS SIDE UP" and "FRAGILE" shall be clearly marked or stencilled to indicate the face of the package to be kept upward.

FRAGILE

THIS SIDE UP

1.11 PRE-SHIPMENT INSPECTION

The Purchaser shall appoint a team consisting Engineers and they shall be entitled at all reasonable time during manufacture and/or pre-shipment to inspect and witness the Quality Assurance Test (QAT) of the offered item to confirm quality of the equipments to the specification at the manufacturers' premises. Manufacturer shall have all routine test facilities at their own manufacturing premises.

The contractor shall, after consulting the Purchaser, give the Purchaser reasonable notice in writing of the date and place at which any material or equipment will be ready for testing as provided in the contract and if the Purchaser does not attend at the place so named on date, which the supplier has stated in his notice, the Supplier may proceed with the tests, which shall be deemed to have been made in the Purchaser's presence, and shall forthwith forward to the Purchaser duly certified copies of Test Readings.

Inspection Team will witness the following test on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises.

In case of purchasing more than 30,000 (Thirty Thousands) arresters, the Manufacturer shall have to perform tests described in section 1.8.2 on 15 nos. randomly selected samples. In case of purchasing less than 30,000 (Thirty Thousands) arresters, the Manufacturer shall have to perform tests described in section 1.8.2 and 1.8.3 on 10 nos. randomly selected samples.

The tests, as agreed upon by the Purchaser and the Supplier, shall be carried out as per relevant IEC/BS Standard or equivalent.

As and when the Purchaser is satisfied that any materials/equipment shall have passed the relevant tests, the Purchaser shall notify the Contractor in writing to the effect.

Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the items or complete batch if necessary. In that case the Supplier shall have to replace the goods without any financial involvement to the Purchaser.

Nothing in this clause shall in any way release the Supplier from any warranty or other obligations under the contract.

1.12 POST-LANDING INSPECTION AND TESTING

The inspection team constituted by BPDB shall perform post-landing inspection in presence of supplier's representative after the delivery of the item at the designated store of BPDB.

The supplier shall arrange the program of such inspection. Any defect or damage have been found at post-landing inspection, the defective or damaged item to be repaired/ replaced by the supplier at his own cost.

The purchaser's right to inspect, test (where necessary) and reject the items after delivery at the designated store of BPDB shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The PLI Committee in its report shall mention the quantity of goods. The post landing inspection of goods shall generally cover the following, but not limited to:

(i) Visual inspection of goods;
(ii) Conformance with approved drawings with respect to dimensions and type.
(iii) If necessary the inspection team may select randomly 5 to 10 nos. of Arresters from each lot and carryout the test(s) in following manner:
    a. Routine test which will confirm clause no 1.8.2 (Tests which are available in Bangladesh)
    b. Special test in accordance with clause no 1.8.3.
    c. The selected samples will be sent to BUET/RUET/CUET/KUET to carry out the above tests. All costs of testing of samples including carrying, loading, un-loading etc. will be borne by the supplier.

If the tests of lightning arrester(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per above from the same laboratory. If the test of any one of the sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his cost.

7.3. 13 11KV SINGLE PHASE LIGHTNING ARRESTER

1.13 SCOPE

This specification covers the general requirements of the design, manufacture, testing and inspection requirement of 11kV Outdoor Type Single Phase, Metal Oxide (ZnO), Gapless Lightning Arrester and accessories as specified.

1.14 GENERAL :

Lightning arresters shall protect substation and pole-mounted equipment from voltage impulses or surges resulting from lightning strokes, system faults, circuit switching, load rejection or other events. The arresters shall limit such over-voltages to voltage levels below equipment BIL ratings. The country of origin and place of manufacturer shall be same.

1.15 STANDARDS

Performance, Design & Testing of Outdoor Type Single Phase Metal Oxide (ZnO) Gapless Lightning Arrester shall conform to the latest edition of the IEC-60099-4 or equivalent international Standards unless otherwise specified herein.

1.16 SERVICE CONDITIONS

a. Altitude : 1000 meters above the sea level
b. Maximum ambient temperature : 48° C
c. Minimum ambient temperature : 3°C
d. Relative Humidity : 50-100%
e. Average annual rainfall : 3454 mm
f. No. of annual rainy days : 80-120 days
g. Isokeraunic level : 80-120 days/year
h. Pollution of ambient air : dust, salt, chemicals

1.17 SYSTEM PARTICULARS

SL. NO.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL
1.	Nominal System Voltage, KV (Voltage Class)	11
3.	Maximum System Voltage, KV	12
4.	System Frequency, Hz	50
5.	Type of System Grounding	Solidly earthed system
6.	Rated Fault Level (3-Phase Symmetrical), kA 1 sec.	25
7.	Lightning Impulse Withstand Level(LIWL), kV	75

1.18 TECHNICAL REQUIREMENTS

Lightning arrester shall have the following characteristics:

1	Application	Distribution Transformer/ Overhead Line/ Power Cable Line/ Power Transformer of heavy duty class.
2	Type of Arrester	Station Class, Metal Oxide (ZnO), Gapless
3	Construction	Single Unit, gapless hermetically sealed in with non-linear characteristics with high energy capacity, all enclosed in housing.
4	Installation	Outdoor
5	Mounting	Pole Mounted steel bracket
6	Rated Arrester Voltage (rms, Ur)	9kV
7	Continuous Operating Voltage (COV, Uc)	8- 10 kV
8	Number of Phase	1
9	Nominal Discharge Current (kAp) of 8/20 micro second wave	5 kA
10.1	Type of Lightning Arrester housing	Porcelain
10.2	Core Technology	Open Cage Polymeric
10.3	Power Frequency withstands voltage of	≥ 35 kV (Dry) & 30 kV (Wet)

	Lightning Arrester Housing, Dry & Wet.	
10.4	Impulse Withstand Voltage of Lightning Arrester Housing.	≥75 kV (peak)
11	Lightning Impulse Residual Voltage (8/20 micro-second wave)	35 kV (peak)
12	High Current Impulse Withstand Value (4/10 micro-second)	65kV (peak)
13	Creepage distance (minimum)	25 mm/ kV
14	Partial Discharge (pico-coulomb) when energized at 1.05 times its continuous operating voltage.	Not exceeding 10 pC

1.19 BASIC FEATURES

1.19.1 CONSTRUCTION:

Lightning arresters shall be gapless type described briefly as follows:

a. Gap less Arresters shall have elements of zinc oxide to perform both the surge discharge and power frequency reseal functions**.** ZnO arrester shall have excellent thermal stability for high energy surges, external pollution & temporary over voltage.

1.19.2 INSULATORS

The housing insulator of Lightning Arrester shall be wet process porcelain/polymer (Hydrophobic silicon).The insulator sheds shall be designed to minimize the trapping of contamination and shall have a high Creepage distance (minimum 25mm/kV) and a high dielectric strength, as specified in article 1.6 above. Also, the minimum aerial distance between contactterminal to ground shall be 10 inch (254mm) for 11kV.

1.19.3 CONNECTORS

The Line lead and earthing terminal with clamps shall be provided, suitable to accommodate AAC/ ACSR/ Copper Conductor of diameter from 10.0mm to 15 mm.

1.19.4 NAMEPLATE

Information required for identification must be embossed on a stainless steel nameplate firmly fixed to the arrester and shall include:

a. Arrester classification
b. Manufacturers identification or symbol
c. Arrester model and identification number
d. Arrester voltage rating
e. Year of manufacture
f. Contract Number.

1.19.5 MOUNTING

For pole mounted Mounting steel bracket and fixing bolts, nut, washer, Standard clam etc. shall be provided with the arrester for steel cross-arm. The mounting steel bracket & necessary fittings shall be hot dip galvanized as per BS-729.

For structure mounted surge arrester, arrester shall be supplied with insulating base.

1.19.6 FINISH

All exposed steel or iron parts of the arrester except threaded parts smaller than 3 inch in diameter, shall be

hot-dip galvanized in accordance with ASTM A153.

1.20 TESTS:

1.20.1 TYPE TEST CERTIFICATES:

Tenderer's shall include in their offer the following type tests report as prescribed in IEC60099-4 for offered type Lightning Arrester of same voltage class:

i. Insulation withstand test on the arrester housing.
ii. Residual voltage test.
    a. Step current impulse residual voltage test.
    b. Lightning impulse residual voltage test.
    c. Switching impulse residual voltage test.
iii. Long duration current impulse withstand test.
iv. Operation duty test.
    a. High-current impulse operating duty test.
    b. Switching surge operating duty test.
v. Short-circuit test.
vi. Internal partial discharge test.
vii. Bending moment test.
viii. Environmental test.
ix. Seal leak rate test.
x. Radio interference voltage (RIV) test.

1.20.2 ROUTINE TEST:

Manufacturer shall have all routine test facilities for arrester at their own manufacturers' premises. The following routine tests shall be carried out on all the arresters as perIEC 60099-4 and the test reports shall be made available for the observation at the time of inspection.

i. Residual voltage test.
ii. Internal partial discharge test.
iii. Reference voltage test.
iv. Leak test.

1.20.3 SPECIAL TEST:

Following special tests shall be performed during Pre-Shipment Inspection & Post-Landing Inspection(if necessary).

a. Insulation resistance test :
   Insulation test result shall be more than 1GΩ.

b. Seal Test:
   The randomly selected samples as specified shall be sunk in the 1 (one) meter deep water tank for minimum 4 (four) hours. After removing samples from the water tank, the insulation resistance test shall have to perform again. The insulation resistance test result shall not vary more than 10% before and after seal test. After completing this test the MCOV shall be applied on Arrester at least five times. In each time the result shall be satisfactory as per specification.

1.21 DOCUMENTATION:

The following documents must be submitted along with the tender, without which the tender shall be considered as non-responsive.

1.21.1 Filled up Guaranteed Technical Particular (GTP) of the offered equipment.

1.21.2 Manufacturer's Production capacity as mentioned in Tender Data Sheet (TDS) of tender document.

1.21.3 Outline drawings and internal construction of offered equipment (including surge counter) considering the conceptual arrangement and nomenclature of a 11kV Lightning Arrester.

1.21.3.a At least 02(two) nos. of Manufacturer's Supply Experience for similar type Lightning Arrester of same voltage class within the last 5 (Five) years; years counting backward from the date of publication of Invitation for Tender (IFT) in the newspaper. The Supply Experience covering at least 25% of the Tendered quantity in a single Contract will be considered only.

Manufacturer's supply experience (supported by copy of Contract Agreement and Certificate from purchaser) shall be furnished in the following format:

Sl. No.	**Name, Address, Phone No. E-mail & Fax No. of the Purchaser**	**Contract No. & Date**	**Contract Value**	**Description of material with Quantity**	**Date of completion of supply**
1.					
2.					

1.21.3.b At least 02 (Two) nos. of Manufacturer's Satisfactory Performance Certificates (supported by the supply record) from Electricity Utility as End User depicting that similar type Lightning Arrester of same voltage class has been supplied within last 10 (ten) years; years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 02 (two) year. The Satisfactory Performance Certificate(s) shall be in End User's official pad in English and shall contain End User's full mailing address, e-mail address, website address, fax/telephone number for the convenience of authentication.

1.21.3.c The following provision will be applicable for purchasing less or equal to 5000 (five thousand) nos. of Lightning Arrester from new local manufacturers:

i. At least 02(two) nos. of Manufacturer's Supply Experience for similar type Lightning Arrester of same voltage class within the last5 (Five) years; years counting backward from the date of publication of Invitation for Tender (IFT) in the newspaper. The Supply Experience covering at least 5% of the Tendered quantity in a single Contract will be considered only.

Manufacturer's supply experience (supported by copy of Contract Agreement/ Work Order /Certificate from purchaser) shall be furnished in the following format:

Sl. No.	**Name, Address, Phone No. E-mail & Fax No. of the Purchaser**	**Contract No. & Date**	**Contract Value**	**Description of material with Quantity**	**Date of completion of supply**
1.					
2.					

ii. At least 02 (Two) nos. of Manufacturer's Satisfactory Performance Certificates (supported by the supply record) from public/private organization as End User depicting that similar type Lightning Arrester of same voltage class has been supplied within last 05 (five) years; years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 01 (one) year. The Satisfactory Performance Certificate(s) shall be in End User's official pad and shall contain End User's full mailing address, e-mail address, website address, fax/telephone number for the convenience of authentication.

iii. The New Manufacturer shall submit the following document with the Tender document:

i) Location of the Factory & layout plan.
j) List of Capital Machineries (Related to manufacturer of the Tendered goods).
k) Factory Project Profile
l) Production Line description.
m) List of Key Personnel (with Bio-data).
n) Source of raw materials.
o) Sample of offered item.
p) Testing facilities & calibration certificates of testing equipments.

iv. New Local Manufacturer's factory/manufacturing plant shall be visited & inspected by the Tender Evaluation Committee (TEC) and/or TEC nominated members, to assess the New Manufacturer's production capability and will submit a report regarding Technical and Financial aspect in comparison to the information and document furnished by Tenderer. If the assessment report is not satisfactory, the related tender proposal of the tenderer will be considered as Non-Responsive.

All costs regarding visiting & inspection shall be borne by the New Manufacturer.

Factory shall be inspected by Tender Evaluation Committee (TEC) and/or TEC nominated members as per following guide lines:

1. Location of the Factory & layout plan.
2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
3. Factory Project Profile
4. Production Capacity (Yearly)
5. Production Line description.
6. List of Key Personnel (with Bio-data)
7. Testing Facilities as per IEC60099-4 or latest revision there on.
8. Source of raw materials.
9. Provide sample of the Tendered product manufactured in the Factory for testing during factory Inspection.
10. Testing of offered type Lightning Arrester and ZnO shall be witnessed at manufacturer’s testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 1.9.4.a & 1.9.4.b) shall be applicable for tender Submission and Evaluation.

1.21.4 Type test report as per clause no. 1.8.1 for offered type Lightning Arresterof same voltage class as per IEC 60099-4. All Type Test shall be done from any of the following independent testing laboratories:

I. CESI, Italy
II. ESEF ASEFA,France
III. JSTC Japan
IV. KEMA, The Netherlands
V. PEHLA, Germany
VI. TUV Rheinland, Germany
VII. SATS, Norway
VIII. STLNA, USA
IX. VEIKI, Hungary
X. ZKU, Czech Republic
XI. UL, USA

1.22 Packing:

The complete Machines are to be export-packed and properly protected for shipment, rough transportation and storage. Specific care shall be taken for protection in store and reference is made to the climatic condition prevailing in Bangladesh. The packing used for equipment shall be 100% waterproof.

The supplier shall be responsible for damages due to inadequate packing. A packing list showing the contents of each packing shall be enclosed in a waterproof envelope secured to the outside of the packing case. A copy of the packing list shall also be enclosed inside the package.

All packages imported are liable to be opened for Customs examination and packing shall therefore be designed to facilitate opening and re-packing thereafter.

A red band (20 cm. wide) shall be painted all around each package. Each package shall have the following information printed on it in bold letters:

- Name of supplier.
- Port of Loading.
- Port of destination.
- Name of Consignee.
- Contract Number.
- Brief description of Stores.
- Number of Packages.
- Gross and net weight.
- Measurements.

In addition, each package shall be clearly marked or stencilled in red on two sides, the shipping mark, "Name of Utility, Bangladesh" inscribed within a triangle mark as shown below:
The Shipping Mark

UTILITY'S LOGO
BANGLADESH

On the other two sides arrow marking with the wording "THIS SIDE UP" and "FRAGILE" shall be clearly marked or stencilled to indicate the face of the package to be kept upward.

FRAGILE

THIS SIDE UP

1.23 PRE-SHIPMENT INSPECTION

The Purchaser shall appoint a team consisting Engineers and they shall be entitled at all reasonable time during manufacture and/or pre-shipment to inspect and witness the Quality Assurance Test (QAT) of the offered item to confirm quality of the equipments to the specification at the manufacturers' premises. Manufacturer shall have all routine test facilities at their own manufacturers' premises.

The contractor shall, after consulting the Purchaser, give the Purchaser reasonable notice in writing of the date and place at which any material or equipment will be ready for testing as provided in the contract and if the Purchaser does not attend at the place so named on date, which the supplier has stated in his notice, the Supplier may proceed with the tests, which shall be deemed to have been made in the Purchaser's presence, and shall forthwith forward to the Purchaser duly certified copies of Test Readings.

Inspection Team will witness the following test on random sampling basis (sample selected by the Inspection Team) during factory test in manufacturer's factory premises.

In case of purchasing more than 30,000 (Thirty Thousands) arresters, the Manufacturer shall have to perform tests described in section 1.8.2 on 15 nos. randomly selected samples. In case of purchasing less than 30,000 (Thirty Thousands) arresters, the Manufacturer shall have to perform tests described in section 1.8.2 and 1.8.3 on 10 nos. randomly selected samples.

The tests, as agreed upon by the Purchaser and the Supplier, shall be carried out as per relevant IEC/BS Standard or equivalent.

As and when the Purchaser is satisfied that any materials/equipment shall have passed the relevant tests, the Purchaser shall notify the Contractor in writing to the effect.

Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the items or complete batch if necessary. In that case the Supplier shall have to replace the goods without any financial involvement to the Purchaser.

Nothing in this clause shall in any way release the Supplier from any warranty or other obligations under the contract.

1.24 POST-LANDING INSPECTION AND TESTING

The inspection team constituted by BPDB shall perform post-landing inspection in presence of supplier's representative after the delivery of the item at the designated store of BPDB.

The supplier shall arrange the program of such inspection. Any defect or damage have been found at post-landing inspection, the defective or damaged item to be repaired/ replaced by the supplier at his own cost.

The purchaser's right to inspect, test (where necessary) and reject the items after delivery at the designated store of BPDB shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The PLI Committee in its report shall mention the quantity of goods. The post landing inspection of goods shall generally cover the following, but not limited to:

(i) Visual inspection of goods;
(ii) Conformance with approved drawings with respect to dimensions and type.
(iii) If necessary the inspection team may select randomly 5 to 10 nos. of Arresters from each lot and carryout the test(s) in following manner:
    a. Routine test which will confirm clause no 1.8.2 (Tests which are available in Bangladesh)
    b. Special test in accordance with clause no 1.8.3.
    c. The selected samples will be sent to BUET/RUET/CUET/KUET to carryout the above tests. All costs of testing of samples including carrying, loading, un-loading etc. will be borne by the supplier.

If the tests of lightning arrester(s) are not satisfactory then the inspection team will randomly select double of the earlier sample size and carryout the test as per above from the same laboratory. If the test of any one of the sample fails, the batch under this inspection will be rejected and the delivered quantity will be taken back from the store by the supplier at his cost.

7.3. 14 SUBSTATION BATTERY

7.3. 14.1 Battery

7.3.14**.1.1 General**

Batteries shall be located in separate mechanically ventilated rooms, which will be provided with sinks and water supplies. Storage facilities will be provided for electrolyte, distilled water and maintenance equipment.

The voltage measured at the main distribution switchgear shall not vary by more than plus 10 percent or minus 20 percent of the nominal voltage under all charging conditions when operating in accordance with the requirements of this Section.

The complete equipment shall preferably be a manufacturer's standard but any departure from this Specification shall be subject to the approval of the Engineer.

7.3. 14**.1.2 Type of Battery**

The battery shall be of the high performance Nickel Cadmium pocket plate type complying with IEC 60623 and shall be designed for a life expectancy of 25 years.

Battery cases shall be of high impact translucent plastic or annealed glass and shall be indelibly marked with maximum and minimum electrolyte levels. The design of the battery shall permit the free discharge of the gases produced during the normal operating cycle, whilst excluding dust. Spray arresters shall be included.

The electrolyte shall be free from impurities and the Potassium Hydroxide used shall comply with BS 5634. Dilution of the alkaline electrolyte and topping up of cells shall be carried out using distilled water only.

A complete set of test and maintenance accessories, suitably boxed, shall be provided for each battery. A syringe hydrometer and a durable instruction card shall be included in each set.

Cells shall be numbered consecutively and terminal cells marked to indicate polarity.

Cells shall be permanently marked with the following information:

- Manufacturer's reference number and code
- Year and month of manufacture
- Voltage and nominal capacity at the 5 hour discharge rate

The electrolyte capacity and general design of the cells shall be such that inspection and maintenance, including topping up of the electrolyte, shall be at intervals of not less than twelve months.

7.3. 14**.1.3 Initial Charge and Test Discharge**

The initial charge, test discharge and subsequent re-charge of the battery must be carried out under continuous supervision. Resistors, instruments, leads, and the other apparatus will be necessary for the initial charge, test discharge and subsequent recharge of the battery.

7.3. 14**.1.4 Battery Duty**

The battery shall have sufficient capacity to supply the following continuous and intermittent loads for the periods specified, with the chargers out of service.

Standing DC loading for protection, control, indications and alarms for 10 hours. This loading shall be determined from all equipment to be supplied on this Contract. In addition the future circuit requirements estimated on the same basis as the present requirements.

At the end of 10 hours the battery shall have sufficient capacity to complete the operations listed below, at the end of which duty the system voltage shall not have dropped below 90 percent of the nominal voltage with the standing loads, specified above, connected.

1. Two closing operations on all circuit breakers (including future) supplied by the battery.
2. Two tripping operations on all circuit breakers (including future) supplied by the battery. Where busbar protection is provided, it shall be assumed that all circuit breakers in any one busbar protection zone trip simultaneously.
3. Charging of DC motor wound circuit breaker closing springs (where applicable) to enable the closing operations to be carried out.
4. At the end of these duties, the battery voltage shall not have dropped such that the voltage at the battery terminals falls below 90% of the nominal system voltage when supplying the standing load.

5. In addition, the voltages at the terminals of all components in the system (eg. relays, trip and closing coils) shall not be outside of the individual voltage limits applying to them.
6. A margin of 10 % shall be allowed for derating of this battery over its life time.

All quantities derived in this manner shall be quoted in the Bid, but shall not be used for ordering materials until specifically approved by the Engineer. Detailed calculations, and loading characteristics on which these are based, shall be submitted to the Engineer at an early stage.

7.3. 14**.1.5 Location of Batteries**

The batteries shall be housed in a ventilated battery room. The charging equipment and distribution switchboards shall be housed in a separate room.

The floor of the battery room shall be coated with a suitable electrolyte resistant protective coating. The floor shall be fitted with a drain and shall have sufficient slope to prevent any major electrolyte spillages from entering into other areas.

No ducts or any other items shall penetrate the floor or create a means whereby spillage can drain away apart from the drain provided for this purpose.

The ventilation fans and lamps in battery room shall be an explosion proof type.

7.3. 14**.1.6 Battery mounting connections and accessories**

Batteries shall be placed on timber boards mounted in double tiers on steel stands of robust construction and treated with acid resisting enamel or gloss paint to BS 381C No.361. The cells shall be arranged so that each cell is readily accessible for inspection and maintenance and it shall be possible to remove any one cell without disturbing the remaining cells. The stands shall be mounted on insulators and be so dimensioned that the bottom of the lower tier is not less than 300mm above the floor.

Alternatively, batteries may be mounted in a similar manner on treated hardwood stands.

Batteries shall be supplied and erected complete with all necessary connections and cabling. Connections between tiers, between end cells and between porcelain wall bushings shall be by PVC cables arranged on suitable racking or supports. Before jointing, joint faces shall be bright metal, free from dirt, and shall be protected by a coating of petroleum jelly. Terminal and intercell connections shall be of high conductivity corrosion free material.

Cartridge fuses shall be provided in both positive and negative leads, positioned as close to the battery as possible and shall be rated for at least three times the maximum battery discharge current at the highest operating voltage. The two fuses shall be mounted on opposite ends of the battery stand or rack in an approved manner. These fuse links shall comply with BS 88 Clause DC. 40 and shall be bolted in position without carriers.

Warning labels shall be fitted to warn personnel of the danger of removing or replacing a fuse whilst the load is connected and that fuses should not be removed immediately following boost charge due to the possible ignition of hydrogen gas.

Fuses between the battery and charger shall be located adjacent to the battery in a similar manner to that described above. A warning label shall be placed on the charging equipment indicating the location of these fuses and the fact that they should be removed to isolate the charger from the battery.

It shall not be possible to leave the battery disconnected (by means of switches or removal or operation of fuses) without some local and remote indication that such a state exists.

One set of miscellaneous equipment, including two syringe hydrometers, one cell-testing voltmeter, two cell-bridging connectors, two electrolyte-pouring funnels, two electrolyte thermometers, battery instruction card for wall mounting, electrolyte airtight containers, labels, tools and other items necessary for the erection and correct functioning and maintenance of the equipment, shall be provided for each station.

7.3. 15 BATTERY CHARGER

7.3.15.1 General:

Each battery charging equipment shall comply with the requirements of BS 4417 (IEC 146), shall be of the thyristor controlled automatic constant voltage type with current limit facilities and shall be suitable for supplying the normal constant load, at the same time maintaining the battery to which it is connected in a fully charged condition. All equipment shall be naturally ventilated.

All the equipment for each charger shall be contained in a separate ventilated steel cubicle. The charger cubicles shall normally be mounted immediately adjacent to the DC distribution panel to form a board and shall be of matching design colour and appearance.

Where their ratings permit, chargers shall preferably be designed for operation from a single-phase AC auxiliary supply with a nominal voltage of 230 V. Otherwise a three phase 400V supply may be utilised. Chargers shall maintain the float charge automatically for all DC loads between 0 and 100%, irrespective of variations in the voltage of the ac supply within the following limits :

- Frequency variation : 47 to 51 Hz.
- Voltage variation : ± 15%

The mains transformer shall be of a suitable rating and design. Clearly marked off-circuit tappings shall be provided on the primary windings and change of tapping shall be by means of easily accessible links. The transformer shall be of the natural air-cooled type capable of operating continuously at full load on any tapping with the maximum specified ambient temperature.

All rectifiers and semi-conducting devices employed in the charger shall be of the silicon type. They shall be adequately rated, with due regard to air temperature within the charger enclosure, for the maximum ambient temperature.

The rating of the charger on float charge shall be equal to the normal battery standing load plus the recommended finishing charge rate for the battery.

Each charger shall also incorporate a boost charge feature which shall, after having been started, provide an automatically controlled high charge rate sufficient to restore a fully discharged battery to the fully charged state within the shortest possible time without excessive gassing or any form of damage to the battery. The boost charge shall be initiated manually or automatically upon detection of a significant battery discharge. An adjustable timer shall be provided to automatically switch the charger to the float condition after the correct recharge period.

Should the AC supply fail while a battery is on boost charge, the switching arrangements shall automatically revert the charger to float charge status and then reconnect the battery to the distribution board.

The output voltage regulator shall be adjustable for both float and boost charge modes, within limits approved by the Engineer, by means of clearly marked controls located inside the cubicle.

Although it is not intended that the charger be operated with the battery disconnected, the design of the charger shall be such that with the battery disconnected the charger will maintain the system voltage without any damage to itself and with a ripple voltage no greater than 2.0% rms of the nominal output voltage.

The charger shall automatically adjust the charging current from a value not less than the battery capacity divided by 10 hours to a minimum value of not more than the battery capacity divided by 200 hours. The charging circuitry shall be so designed that the failure of any component will not give a situation which will cause permanent damage to the battery by over charging.

Each charger shall have a float charge maximum current rating sufficient to meet the total standing load current on the dc distribution board plus a battery charging current equal numerically to 7% of the battery capacity at the 10 hour rate.

Each charger shall be designed with a performance on float charge such that with the output voltage set at approximately 1.45 V per cell at 50% load and rated input voltage and frequency, the output voltage shall not vary by more than plus 3% to minus 2% with any combination of input supply voltage and frequency variation as stipulated in this Specification and output current variation from 0-100% of rating.

Each charger shall be suitable for operating alone or in parallel with the other charger. When operating with both chargers, one charger shall be arranged to supply the standing load with the second charger in the quiescent standby mode.

Each charger shall also have a taper characteristic boost charging facility which shall be selectable by a float/boost charge selection switch and which will give boost charging of 1.60 volts per cell.

Each charger shall be designed with a performance on boost charge such that with rated input voltage and frequency the charger output shall not be less than its rating in Watts at 1.3 V and 1.6 V per cell, and also the output voltage shall be 1.60 per cell over an output range of 0 - 100% of rating.

The boost charging equipment shall be capable of recharging the battery within six hours following a one hour discharge period.

In the event of the battery becoming discharged during an AC supply failure, the rate at which recharging commences shall be as high as possible consistent with maintaining the automatic charging constant voltage feature and with the connections remaining undisturbed as for normal service.

The charger shall have an automatic boost/quick charge feature, which shall operate upon detection of a significant battery discharge. When, after a mains failure, the AC supply voltage returns and the battery have been significantly discharged, the charger will operate in current limit. If the current limit lasts for more than a specified time and the charging current does not fall back to float level, the automatic high rate charge shall be activated.

An override selector switch shall be provided inside the charger unit to enable a first conditioning charge to be made, in line with the battery manufacturer’s recommendations, for batteries which are shipped dry and require forming at site.

A blocking diode unit shall be incorporated in the output circuit of each charger to limit the load voltage during boost charging of the battery. The diode unit shall not be in service in the normal float charging mode. Should the stabiliser fail in the boost charging mode, the charger shall automatically revert to the float mode.

An anti-parallelling diode shall be provided in each positive feed to the DC distribution board to prevent faults on one supply affecting the other. These diodes shall be continuously rated to carry the maximum possible discharge current likely to occur in service and a safety factor of 4 shall be used to determine the repetitive peak reverse voltage rating. The I2t rating of the diodes shall be such that in the event of a DC short circuit, no damage to the diodes shall result.

Each charger shall be capable of sustaining, without damage to itself, a continuous permanent short circuit across its output terminals. The use of fuses, MCBs or other similar devices will not be acceptable in meeting this requirement.

Suitable relays shall be provided for each charger to detect failure of the incoming supply and failure of the DC output when in float charge mode. These relays shall operate appropriate indicating lamps on the respective charger front panel and shall have additional voltage free contacts for operating remote and supervisory alarms. These alarms shall be immune from normal supply fluctuations and shall not be initiated when any one charger is taken out of service.

The charger shall also be fitted with a device to de-energise the charger in the event of a DC output float over voltage.

Each charger shall be provided, as a minimum, with the following instrumentation, indication and alarm facilities:-

- Indicating lamps for the AC supply to the rectifier and DC supply from the rectifier.
- Indicating lamps for float and boost charging operations.
- Voltmeter - Input voltage.
- Voltmeter - Output voltage.
- Ammeter - Output current.
- Alarm - Charger failure.
- Alarm - Mains failure.

The following battery alarms shall also be provided:

- Battery fuse failure
- Diode assembly failure
- Battery circuit faulty
- Low DC volts
- High AC volts
- Earth fault +ve
- Earth fault -ve

Lamp test facilities shall be included.

A “charger faulty” alarm for each charger and a “battery faulty” alarm shall be provided in the substation control room and to the SCADA system where applicable.

Each battery charger shall be equipped with charge fail detection equipment to give local indication and remote alarm if the voltage from the charger falls below a preset level which will be lower than the nominal float charge voltage. Suitable blocking diodes shall be provided to prevent the battery voltage being supplied to the equipment and so prevent charge fail detection.

The device shall not operate on switching surges or transient loss of voltage due to faults on the AC system. The voltage at which the alarm operates shall be adjustable for operation over a range to be approved by the Engineer.
Each charger shall be equipped with a switch-fuse for the incoming AC supply and an off load isolator for the DC output. An additional Ammeter for input current measurement shall be provided with the charger.

DC Battery Charger's monitoring & controlling Devices/System shall be incorporated in SAS. Charger Controller shall monitor all voltage & current levels, physical condition of battery cells, self-supervision of charger equipment etc. There shall be protective scheme against over/under current & voltage flow. All the measurement values & alarm signals shall be available on controller display and to be indicated with necessary Annunciation with hooter/Indication LED Lamp where applicable in charger panel & shall also to be incorporated in SAS.

Bidders shall include particulars with their Bid on the method of adjustment included to compensate for ageing rectifier elements. The construction of the charger shall be such that access to all components is readily available for maintenance removal or replacement. Internal panels used for mounting equipment shall be on swing frames to allow for access to the charger interior.

7.3. 15.2 Earthing Screen

Earthed screens shall be provided to protect the equipment from direct lightning strikes. The screens shall be of aluminium clad steel wires of not less than 50 sq.mm. total section, and connected to provide low impedance paths to earth.

The layout of the earth wires shall be such that equipment to be protected generally lies within areas bounded by two or more conductors, in which case the protected angle shall not exceed 45 degree centigrade. Where equipment is protected by a single earth wire, the protective angle shall not exceed 35 degree centigrade to the vertical.

The earth screens shall be suitable for extension to protect the substation equipment to be installed in future stages of development.

Connections shall be made of copper strip of 30mm x 5mm cross section between the overhead earthed screen wire and the main substation earthing system at each support unless the galvanized steel support structure has sufficient area and current carrying capacity.

Earth wires shall be held in clamps with free pin type joints between clamps and supports.
Connections shall be provided for the terminations of the earth wires of the overhead lines, including bimetal connectors where necessary.

The design of all structures shall generally comply with the specification and in addition is to ensure that in the event of breakage of one earth wire, the Factor of Safety is not less than 1.5.

7.3. 15.3 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of **Battery and Battrey charger**.
b) Outline and General Arrangement drawings.

7.3. 16 TECHNICAL SPECIFICATIONS 33kV DISC INSULATOR WITH FITTINGS

7.3. 16 .1 STANDARDS:

These 33 kV Disc Insulator with Fittings specified in this Section shallconform to the latest edition of the following standards for operation in overhead lines in air under local ambient conditions. Design, Manufacture, Testing and Performance shall be in accordance with latest revisions of BS, IEC standards as listed below or other equivalent internationally acceptable Standards:

IEC-120	:	Ball & Socket Coupling.
IEC-305	:	Characteristics of String Insulator Unit.
IEC-383	:	Insulator Tests.
IEC-437	:	Radio Interference Tests.
IEC-506	:	Switching Impulse Tests.
IEC-575	:	Thermal Mechanical Performance Tests.
BS-137	:	Method of test & requirements.
BS-916	:	Bolts, Screws & Nuts.

7.3. 16 .2 SPECIFICATIONS:

A. Specification of Disc Insulator:

These 33 kV Disc Insulators shall be designed as per above standards for operation in overhead lines in air under local ambient conditions.

1.	Installation	Overhead line for suspension or termination.
2.	Nominal System Voltage, kV	33 (line to line).
3.	Type of System	Three phase, 50 Hz, Three Wire, Effectively earthed.
4.	Highest System Voltage, kV	36 (three phase).
5.	Atmospheric Condition	Moderately polluted.
6.	Altitude, meter	0-300 above sea level.
7.	Maximum Ambient Temperature, ^{o}C	45.
8.	Insulator Material	The Insulator shall be made of good commercial grade wet process porcelain. The porcelain shall

		be sound, thoroughly vitrified and free from defects and blemishes that might adversely affect the life of the Insulator. The exposed parts of the porcelain shall be smoothly glazed and shall be brown in color unless otherwise specified.
9.	Type of Insulator	Ball & Socket type Disc, security clip made of Stainless Steel or Phosphor Bronze.
10.	Markings	Each Insulator shall be marked with the name of Trade Mark of the manufacturer, the type of Insulator and the year of manufacture. These markings shall be legible and indelible.
11.	Maximum Nominal Diameter of Insulator, mm	255
12.	Nominal Spacing, mm	146
13.	Minimum Nominal Creepage Distance, mm	292
14.	Coupling Size, mm	16
15.	**WITHSTAND VOLTAGE, MINIMUM**	
15.1	Power Frequency, dry (one minute), kV	70
15.2	Power Frequency, wet (one minute), kV	40
15.3	Impulse 1.2x50 micro-sec wave, kV	170
16.	**FLASHOVER VOLTAGE, MINIMUM**	
16.1		78
16.2	Power Frequency, dry, kV	45
16.3	Power Frequency, wet, kV	180
16.4	50% Impulse 1.2x50 micro-sec wave, positive, kV	185
	50% Impulse 1.2x50 micro-sec wave, negative, kV	
17.	**POWER FREQUENCY PUNCTURE VOLTAGE MINIMUM, kV**	110
18.	**RADIO-INFLUENCE VOLTAGE DATA MINIMUM:**	
18.1	Power Frequency Test Voltage, RMS to Ground, kV	10
18.2	Maximum RIV at 1000 KC Micro-volt	50
19.	**MECHANICAL FAILING LOAD MINIMUM, kN**	70

B. Specification of 33 kV Strain Insulator String Set:

33 KV Strain Insulator String Set consisting of the following component parts for each set. Design, Manufacture, Testing and Performance shall be in accordance with latest revisions of BS-3288 or other equivalent internationally acceptable Standards.

1.	Anchor Shackle	Made of forged steel galvanized complete with cotter bolt and Pin, UTS-6800 Kg, Galvanization as per BS-729 OR ASTM A-153 part 1 or ASTM A-153.
2.	Ball Eye	Oval eye type, made of forged steel galvanized, UTS-6800 Kg, Galvanization as per BS- 729 part 1 or ASTM A-153.
3.	Socket Eye	Made of malleable iron galvanized complete with cotter bolt and Pin, UTS-6800 Kg, Galvanization as per BS- 729 part 1 or ASTM A-153.
4.	Strain Clamp	Bolted type, Made of malleable iron galvanized or Alluminium Alloy, suitable for accommodating ACSR GROSBEAK of overall diameter 25.15 mm, complete with bolts, nuts, washers, Alluminium Alloy liner etc., UTS-6800 Kg, Galvanization as per BS- 729 part 1 or ASTM A-153 in case of malleable iron or other ferrous metal.
5.	Disc Insulator	3 (Three) Nos. are required for each set.

7.3.17 H-TYPE CONNECTORS

7.3.17.1 STANDARDS:

The H-Type Connectors as specified in this Section shallconform to the latest edition of the following standards for operation in overhead lines in air under local ambient conditions. Design, Manufacture, Testing and Performance of the H-Type Connector shall be in accordance with the BS-3288 Part-1 &BS-4579 Part 3 or equivalent International standards.

7.3.17.2 SPECIFICATIONS:

The H-Type Connectors will be used for connecting the ACSR Conductors to ACSR Conductors, AAC Conductors to AAC Conductors and Copper Conductors to AAC conductors. These should be Uni-metal or Bi-metal type according to the contractions and applications of such connectors.

These should be made from high conductivity Aluminium and pre-filled with oxide inhabiting compound. The design of the compression type connectors should be such that galvanic corrosion is minimised. Conductor rough & tooling shall be clearly joined on the connectors.

The connector must have at least the same conductance as the conductor for which it is intended to be used and shall carry the full continuous current rating of the conductor size they are designed for.

The original quality of contacts shall be maintained through out the service life of the connectors. Glow discharge and radio interference must be reduced to a minimum level.All compression type connectors shall be suitable for installation, using either manual or hydraulic compression tools.

The size of the connectors for different Conductors is as follows:

	Grove A	**Grove B**	

	Max (mm^2)	Min (mm^2)	Max (mm^2)	Min (mm^2)	Length in mm
ACSR GROSBEAK/ACSR GROSBEAK	400	350	400	350	150.00
ACSR MERLIN/ACSR MERLIN	185	150	185	150	112.00
ACSR DOG/ ACSR DOG	120	95	120	95	63.00
AAC WASP/ AAC WASP	120	95	120	95	63.00
AAC ANT/ AAC ANT	70	50	70	50	47.00
AAC WASP / Service Bail	120	95	35	16	63.00
AAC ANT /Service Bail	70	50	35	16	47.00

INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered Accessories.
b) Dimensional drawing of offered Accessories.
c) Detail description of testing facilities at manufacturer's plant.

7.3. 18 SHIELD WIRES:

1.	Installation	Sub-station
2.	Type	Stranded
3.	Material	High Strength Steel
4.	Nominal Size	9.525 mm
5.	Number of Strand	7 (Seven)
6.	Diameter of Each Strand	3.05 mm
7.	Overall Diameter	9.525 mm
8.	Weight per KM Length	407 Kg
9.	Rated Ultimate Tensile Strength	4,900 Kg/mm^2
10.	Class of Zinc Coating	Class-A
11.	Galvanization	As per BS-729 OR ASTM A-153
12.	Grade of Steel	60,000 Kg
14.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. FEATURES

- Wires shall be shipped on standard non-returnable wooden reels Gross weight shall not exceed 800 Kg per reel. The minimum length of wire per reel shall be 1500 M.
- Each reel shall have the following information stenciled on side size and kind of conductor, length of conductor, gross and net weight. No joints of any kind shall be made in the finished wire entering into the construction of strand.
- The diameter of each zinc coated wire forming the strand shall not differ from the diameter specified by more than plus or minus 0.01 mm.

- The strand shall have a left hand lay with a uniform pitch of not more than 16 times the normal dia. of the strand.

B. PACKING AND SHIPPING

Grounding wire reels shall be constructed sufficiently strong to withstand usual requirement shipping, transporting and field erection.

C. HARDWARE FOR SHIELD WIRE

i) Angular 90^0 bolted type T-connector of malleable iron galvanized steel or aluminum alloy suitable for 9.525 mm dia, 7/3.05 mm stranded high strength galvanized steel wire run to 9.525 diameter, 7/3.05 mm stranded high strength galvanized steel wire tap.
ii) Angular 45^0 bolted type clamp made of aluminum alloy suitable for 9.525 mm diameter, 7/3.05 mm stranded high strength galvanized steel wire run to 9.525 mm diameter 7/3.05 mm stranded galvanized steel wire tap.

iii) Shield wire clamp set suitable for 9.525 mm diameter 7/3.05mm stranded high strength galvanized steel wire, comprising of the followings :
   a) Bolted wire strain clamp made of malleable iron galvanized steel or aluminum alloy complete with nuts bolts washers etc. anchor shackle made of forged steel galvanized complete with cotter bolt and pins.
   b) Double eye rectangular made of forget galvanized.
   c) Wire clip made of malleable iron galvanized or aluminum alloy.

7.3. 19 PG CLAMP

7.3. 19 .1 STANDARDS:

The PG Clamps as specified in this Section shallconform to the latest edition of the following standards for operation in overhead lines in air under local ambient conditions. Design, Manufacture, Testing and Performance of the PG Clamp shall be in accordance with the BS-3288 Part-1 &BS-4579 Part 3 or equivalent International standards.

7.3. 19 .2 SPECIFICATIONS:

The PG Clamps will be used for connecting the ACSR Conductors to ACSR Conductors and AAC Conductors to AAC Conductors. Parallel Groove Clamp, a non tension bolted type connector, shall be made of Aluminium Alloy, massively designed body. The bolts are made of Galvanised Steel. For the insulated conductors, 0.80 mm thick PVC insulation cover is to be provided with full length clamp.

The clamps must have at least the same conductance as the conductor for which it is intended to be used and shall carry the full continuous current rating of the conductor size they are designed for.

The original quality of contacts shall be maintained through out the service life of the clamps. Glow discharge and radio interference must be reduced to a minimum level.

The size of the connectors for different Clamps is as follows:

	Conductor Size (sq. mm)	Conductor Diameter (mm)	**Dimension**		No. of Bolt
			L (mm)	W (mm)	

Information Required

ACSR GROSBEAK, either side	370	25.15	125	50	3
ACSR MERLIN, either side	170	17.35	110	45	3
ACSR DOG, either side	100	14.15	95	30	2
ACSR RABBIT, either side	50	10.05	80	22	2
AAC WASP, either side	100	13.17	95	30	2

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered Accessories.
b) Dimensional drawing of offered Accessories.
c) Detail description of testing facilities at manufacturer's plant.

7.3. 20 LV AC DISTRIBUTION PANEL

Vermin and dust proof, completely metal enclosed by sheet steel (11 SWG) with necessary reinforcement, colour, Grey with appropriate spray painting, free standing type, compact in size, suitable for opening at the back by hinged door with locking device.

There shall be a 3 phase 400 A, 1 KV bus (Cu) arrangement with neutral. Bus being connected with the following MCCB's and instrument. :

Voltmeter with 6-position selector switch connected to the bus.

2 × 400A, 4 pole MCCB being interlocked with each other, operative one at a time to bring the input Power to the Bus. Both these incoming feeders shall have 3 x ammeter (each).
2 × 100A, 3 pole MCCB as outgoing.
10 × 60A, 3 pole MCCB as outgoing.
10 × 30A, 3 pole MCCB as outgoing.

The Short Circuit Current rating of each 3 phase MCB and MCCB shall be of at least 36 kA and that for 1 phase shall be at least 10 kA.

All MCCB's are provided with over load setting and short circuit tripping device.

There shall be a 3-φ 4-wire class 0.5 energy meter for recording the station use.

ACDB's AC supply entry point from Auxiliary TR (can be panel mounted) or Auxiliary TR's LT side shall have Over Voltage protector installed.

Necessary terminal blocks and glands/openings shall be provided for the entry of suitable cables.

All equipment/instruments inside the panel shall be arranged neatly and sufficient space shall be provided for easy approach to each equipment/instrument.

Thermostat controled panel heater, bulb for inside illumination of panel shall be provided.

All other features as stated in the table of guaranteed data schedule shall applicable also.

LV AC distribution panel shall have a monitoring Devices/System that shall monitor all voltage & current levels, physical status of AC Supply MCBs, self-supervision of controller equipment etc. There shall be protective scheme against over/under current & voltage flow. All the measurement values & alarm signals shall be available on monitoring devices display and to be indicated with necessary Annunciation with hooter/Indication LED lamp where applicable in ACDB panel & shall also to be incorporated in SAS. AC change over switch controlling Devices shall also be incorporated in SAS; necessary measurement, controlling, status & alarm signals shall be available in ACDB & SAS.

7.3.21 DC DISTRIBUTION PANEL

The switchboard shall comply with the requirements of BS 5468 (IEC 60439)

The distribution switchboard shall be of the cubicle type or otherwise incorporated in the cubicles for battery chargers. Double pole switches and fuses or switch fuses (miniature circuit breakers to BS 4752 or IEC 60127 may only be used if it can be shown that there will be no discrimination problems with sub-circuits) shall be fitted to the DC switchboard as required by substation services but, as a minimum requirement, that set out in the Schedule A of Requirements.

Distribution panels shall be mounted adjacent to the charger control panel and shall be of the cubicle type complying with the general requirements of cubicle type control panels. No equipment associated with the chargers shall be installed in the distribution board.

Distribution panels shall incorporate double-pole switches for each of the outgoing DC circuits and double-pole isolators for the incoming DC supplies. The panel shall be provided with a voltmeter and centre zero ammeter on each incoming circuit.

A double pole switch or contactor shall be provided for the purpose of sectionalising the busbar.

A battery earth fault detecting relay, which will centre tap the system via a high resistance, shall be incorporated in the distribution panel.

A low voltage detecting device for the system shall be incorporated in the distribution panel. No-volt relays will not be accepted for these devices. The voltage setting shall be adjustable over an approved range.

In addition to any other requirements specified elsewhere, the battery earth fault detecting relays and low voltage devices shall each have three alarm contacts, one for local visual annunciation, one for the station control panel alarm indication and one for potential free contact for external supervisory alarms. A lamp test facility shall be provided.

Connections between the battery and the distribution cubicle shall be made in PVC insulated cable as required. Cable laid in runs where it may be subject to damage shall be protected by wire armouring, be sheathed overall and be cleated to walls as required.

Cable boxes or glands shall be provided as appropriate for all incoming and outgoing circuits of the distribution switchboard and associated battery chargers. Each circuit shall be suitably labelled at the front of the panel and at the cable termination where the terminals shall be additionally identified.

Charging and distribution switchboards shall be provided with an earthing bar of hard drawn high conductivity copper which shall be sized to carry the prospective earth fault current without damage or danger.

The cubicles for the chargers and distribution boards shall be of rigid, formed sheet metal construction, insect and vermin proof, having front facing doors allowing maximum access to the working parts, when open. The design of the cubicles for the chargers shall be such as to prevent the ingress of dust and minimise the spread of flames or ionised zones, shall be to IEC 60529 IP52, but at the same time shall provide all necessary ventilation and cooling. The design of the frames shall allow the clamping and holding of all chokes, transformers and similar sources of vibration, so that vibration will be minimised, satisfy relevant standards, and not limit the life of the equipment. The frame shall allow the fixing of lifting and so that the equipment remains properly mechanically supported whilst being transported, lifted and installed.

DC distribution panel shall have a monitoring Devices/System that shall monitor all voltage & current levels, physical status of DC Supply MCBs, self-supervision of controller equipment etc. There shall be protective scheme against over/under current & voltage flow and DC positive & negative earth faults. All the measurement values & alarm signals shall be available on monitoring devices display and to be indicated with necessary Annunciation with hooter/Indication LED lamp where applicable in DCDB panel & shall also to be incorporated in SAS.

7.3.22 SUB-STATION STEEL STRUCTURE

GENERAL

The structural steel shall conform to the latest provision of ASTM A36/BS-4360 and all the parts shall be hot dip galvanized as per BS-729 after fabrication.

SCOPE

The work covered by these specifications shall include design, fabrication, marking, painting, galvanizing, supply of all materials, suitable for the location, sea worthy packing, transportation to S/S site, storage on the site, site visit needed to complete the sub-station structures, miscellaneous steel members, nuts, bolts, plates etc. according to specifications and drawings prepared by the bidder and approved by the Purchaser.

DESIGN DATA

Structure shall be designed on the basis of the following:

i) Buses, structures, conductors and shield wires shall be designed to withstand the force of a true wind velocity of 160 KM per hour (120 kg/m^2 on round surface, 200 KG/m^2 on flat surface). The over load capacity factor shall be 2.

ii) All connections between steel members shall be bolted, minor welds will be allowed for fabrication

purposes before galvanization, but no welding will be permitted in the main legs of members of terminal structure. The diagonals and struts shall be bolted directly to the structure legs and to each other. Gasket plats shall not be used unless absolutely necessary.

Members shall be design to avoid depressions that can trap water, such depressions if unavoidable, shall have drain holes, and connections shall be designed so that all bolts can be tightened in the field using a flat erection wrench. The ends of connected members, shall, where necessary, be clipped or cut to allow free movement of the wrench.

The quantity of bolts, nuts and locking devices furnished shall include the number of each size required for erection plus an additional 5% of that number to cover loss and damages.

The bus supports shall be designed to withstand a momentary short circuit current equal to the momentary short circuit rating of the associated breakers.

All shield wires for the sub-station shall be 9.525 mm dia 7 strands with high strength steel galvanized wire.

The contractor must supply complete detailed drawings, bill of materials, composition of materials etc. all connectors, clamps, fittings, hardware, etc. with their range of adjustment. Detailed catalogues, printed literatures etc. showing all significant characteristics for all those things for which the contractor intends to offer must be supplied with the offer. Particular items proposed to be supplied, must be arrow marked in the catalogue.

Material

All materials used for the sub-station structures and buses shall be new and undamaged and shall conform to the requirements given below certified test reports for all steel materials shall be submitted to the Engineer before such materials shall be fabricated. The latest revisions to the specified American Society for Testing Materials (ASTM) and General Specifications ruling.

i) **STEEL STRUCTURE MEMBER**

The main steel structure shall be designed for the loading specified and separate additional structures as necessary shall be provided for overhead line terminations, disconnect switches, bus supports, potential devices lightning Arresters and other equipment.

The structures steel shall conform to the latest revision of ASTM for “Steel Bridge and Buildings” or equivalent and all parts shall be hot dip galvanized after packing for fabrication.

All structures shall be shipped completely unassembled unless other-wise specified. All S/S parts shall be plainly marked as aid in assembly and the marking shall agree with the identification on the erection drawings.

The structures shall be completed with all bolts, nuts and locking devices which are required for erection of the structures and for installation of equipment.

ii) **CONNECTION FASTENERS**

All connections shall be made with hot dip galvanized, sodium carbon, heat treated, regular square head, bolts to meet Feb Spec FF-B-575. Type-1, Grade-5 or of equivalent standard with hot dip galvanized, heavy semi finished hexagonal nuts. Each fastener shall gave a locking devices by screw and bolt, length of which shall provide 3mm (minimum) to 12.5 mm (maximum) projection beyond nut when connection is tightened. Standard ASTM-A 394 or equivalent.

iii) WELDING ELECTRODE

Where welding is permitted in Fabrication it shall be done in accordance with ASTM specification A233 using F-70 series low hydrogen electrode as recommended by American Welding Society (AWS) or equivalent for various grades of steel.

iv) **GALVANIZED COATING**

All angles, channels, plates and other shaped or members required for these structures shall be galvanized in accordance with ASTM specification A123 or equivalent. Galvanizing is to be applied on after fabrication is competed as per BS-729 (1971) Galvanization shall be done when fabrication is complete.

FABRICATION

The Purchaser/ Engineer shall be notified when fabrication of the materials is to begging so that Owner/ Engineer may, if desires, provide shop inspection.

Each steel component shall be completely fabricated and then galvanized in the shop. All workmanship and finishing shall be first class and equal to the best practices in modern steel fabricating shops. All angles and members shall be fabricated in accordance with the standard, specifications and details given in the edition of the “Steel Construction Hand-Book” issued by the American Institute of Steel Construction or its equivalent. Structural item as delivered to the job site shall have all members straight, free from warp, bends or local deformations, accurate, sot that when the structure is assembled, proper fit will be provided. All reaming of holes shall be done at the factory before galvanizing. Punching, drilling or reaming of holes after galvanizing will not be permitted. Holes, 18mm in diameter shall be provided in the steel for ground connection on each leg of each structure. Legs or members shall be drilled with 18 holes at 1.5m intervals, in all of members where ground conductors are to be installed for grounding of shield wires or equipment. These holes shall be made before galvanizing. Holes shall be drilled and attachment devices shall be furnished on the terminal structures for all overhead circuit conductors and shield wires.

The bolt holes shall not exceed the diameter of the bolt by more than 1.5mm. Leg angles and other members shall be lap spliced and the back of the inside angle shall be round to clear the fillet of the outside angles.

i) **WELDING**

All welding done in the shop on steel members shall be by the shield metal are processes using joints details performed in accordance with the American Welding Society (AWS) code or equivalent. All welding procedures and operators shall be qualified by an independent testing laboratory in accordance with AWS standard qualification procedures. Accurate records of operator and procedure qualifications shall be maintained by the contractor and shall be available to the owner or Engineer. All welds shall be continues and shall develop full strength of the least strength component unless otherwise shown on the drawings.

Components shall be thoroughly cleaned before welding and shall be accurately fitted and rightly secured

in position during welding and weld surface shall be smooth and uniform and shall be thoroughly cleaned of all slag flux before galvanizing.

ii) **MAKING**

Each separate structure member shall be plainly stamped with a number. All like parts shall have the same number. The marking shall be stamped into the metal with figures at least 15mm high. Impression shall be made before galvanizing and have sufficient depth so that hey are plainly visible after galvanizing. The mark shall be placed as nearly as possible in the same relative position on each pieces so as to be seen plainly after assembly of the structure.

The mark numbers shall be composed of letters and numbers that will designate the S/S and type of structure. These markings shall the same as shown on the fabrication and erection drawings.

iii) **GALVANZING**

All steel components of the structures shall be galvanized using the hot dip process. Fabrications shall be completed before galvanizing. All pieces to be galvanized shall be thoroughly cleaned to remove paint, grease, rust, scales or other materials that could interfere with the bonding of zinc with the steel. Galvanization shall be as per BS-729.

The contractor shall perform all works in accordance with the rules and requirements as specified under ASTM specifications A123, A153 and BS-729.

After galvanizing, steel members may be straightened, if necessary by being re-rolled or pressed only. No punching welding or any other work which may damage the protective cover shall be allowed after galvanizing, except the lapping of nuts. All holes shall be free from pelter after galvanizing.

iv) **DRAWINGS**

The contractor shall furnish to the employer/ engineer complete fabrication and erection drawings along with the strength calculations on buses and loading on each structure foundation of each type of S/S structure for approval before fabrication. Drawings shall show outline, dimensions, drilling and details of fabrications.

STRUCTURE

All structures shall be designed, fabricated, galvanized etc. as specified and as described below :

i) **TERMINAL STRUCTURES**

The “Terminal Structure” is identified as the structure on which the 11 KV services cable/overhead conductor are terminated. When designed to accept the cable termination, this shall be complete with all plates, bases and other fittings required for mounting the cable and box for 11 KV XLPE single core cable of appropriate size 2x1Cx300 Sq.mm cable per phase) with mounting switches etc.

For overload conductors and shield wires, the maximum tension per conductor shall be 450 Kg.

ii) **BUS SUPPORT STRUCTURES**

The bus support structures shall be pedestal type, steel columns used to support the strain ACSR S/S buses. These structures shall be designed to withstand the forces outlined herein without damage off

deformation. All plates and bus support insulators shall be furnished.

STRUCTURE FOUNDATION

The contractors shall furnish the detail design for foundations of all steel structures considering soil pressure of <4880 Kg/m^2. A copy of calculations and design criteria for foundation along with complete bill of materials of sand, cement, reinforcing bar and concrete aggregate etc. shall be furnished after singing of the contract and at the time of drawing approval.

PACKING

i) Steel members shall be shipped unassembled only members with the same mark shall be bundled together.
ii) All packages shall be securely tied with heavy gauge annealed galvanized steel bands to withstand transportation handling.
iii) Parts shall be handled and loaded, without damaging the materials or galvanized coatings.
iv) The contractor shall replace, free charge all materials which has been damaged due to inadequate of faulty packing.

H. TAGGING

i) For erection purpose, each package or bundle shall be tagged to identify the number of pieces.
ii) For shipping purpose separate tagging shall be used for each package and bundle showing the name and number of the contract, gross weight, port of dispatch and the destination in Bangladesh.

7.3.23 BUS-BAR CONDUCTOR AND JUMPERS

1.	Installation	Sub-station, Outdoor.
2.	Type	Aluminum Conductor Steel Reinforced (ACSR)
3.	Code Name	MARTIN ACSR for Bus-Bar Gross Beak ACSR for Jumpers
4.	Conductor Size	1351.5 MCM for MARTIN ACSR 636 MCM for Gross Beak (ACSR)
5.	Standard	Performance, design & testing shall be in accordance to the latest editions of ASTM B-232.
6.	Shipment	On standard non-returnable wooden reels Gross weight shall not exceed 2000 Kg per reel.
7.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. FEATURES

- Shall be of continuous length between supports.
- Conductors to be used for bus bars shall be stressed not more than 33% of their breaking strength.
- Overhead conductors carried by the S/S structures shall be erected with such a tension that when the conductors are subject to a transverse wind pressure of 640 Pascal's on the whole projected area, the factor of safety is not less than 2 (Two).
- When dissimilar metals are in contact, approved means shall be provided to prevent elector-chemical action and corrosion.

ELECTRICAL HARDWARE FOR 33KV SWITCHYARD

- All connectors shall be compression type and made of Aluminum alloy suitable for the conductor.
- Load support clamps shall be complete with bolts, nuts, lock washers etc. complete and of the appropriate size.
- Clamps and fittings made of steel or malleable iron shall be galvanized as per BS-729.
- Joints and connections shall be such as to permit easy dismantling. All necessary terminals and connections (bi-metallic) shall be provided for connection to the equipment. Suspension and tension conductor clamps shall be as light as possible and shall be of approved type.
- Tension conductor clamps shall be not permit slipping of or damage to or failure of the complete conductor or any part, thereof at a load less than 70% of the breaking load of the conductor.
- Catalogue with making on the catalogues of the hardware proposed shall be submitted with the offer.

7.3.24 SUB-STATION EARTHING

A. SCOPE

These Clauses describe the General Requirements for the Earthing and Lightning Protection and shall be read in conjunction with the Project Requirements and Schedules.

B. REFERENCES

American Standard

ANSI/IEEE std 80 : IEEE Guide for Safety in AC Substation Grounding
ANSI/IEEE std 81 : IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potential of a Grounding System.
DIN VDE 0141 : Earthing Systems for Power Installations with Rated Voltages above 1 KV.

British Standards

BS 1432 : Specification for copper for electrical purposes; high conductivity copper rectangular conductors withdrawn or rolled edges.
BS 1433 : Specification for copper for electrical purposes; Rod and bars.
BS 2871 : Specification for copper and copper alloys. Tubes.
BS 2874 : Specification for copper and copper alloy rods and sections (other than forging stock).
BS 4360 : Specification for weldable structural steel.
BS 6360 : Specification for conductors in insulated cables and cords.
BS 6651 : Protection of Structures against Lightning.
BS 6746 : Specification for PVC insulation and sheath of electric cables.
BS 7430 : Code of Practice for Earthing.

International Standards

ISO 427 : Wrought copper-tin alloys - chemical composition and forms of wrought productions.
ISO 428 :Wrought copper-aluminum alloys - chemical composition and forms of wrought productions.
ISO 11 87 :Special wrought copper alloys - chemical composition and forms of wrought products.
ISO 1137 :Wrought coppers having minimum copper contents of 99.85% - chemical composition and forms of wrought products.

C. GENERAL

An earthing System generally in accordance with the requirements of IEEE 80 and BS 7430 shall be designed under this contract. Installation and supply of all materials and equipment also included. The earthing system shall also be including earth electrodes and connections to all electrical equipment and metallic structures on the site. The earth electrodes shall limit the potential rise under fault conditions and buried conductors shall be provided to limit potential differences on the site and adjacent to the site to ensure safety to people and animals. Protection of all electrical equipment against lightning shall also be provided.

D. EXTENT OF WORK

The work under the clause "**SUB-STATION EARTHING"** comprises the site testing, design, supply and installation including excavation, back filling and temporary reinforcement of earthing system and connections to electrical apparatus at the substation. Also included the lightning protection scheme and the provision of portable earthing devices.

The contractor shall be required to undertake all necessary earth resistively tests at the sub-station sites and from the tests result to undertake the design of the earthing system. The design as well as providing safe passage to earth for the stated earth fault currents, shall also include calculation of step, touch and mesh potentials, which shall be within the allowable limits of the standards quoted in the specification.
The design calculations of step, touch and mesh potentials accompanied by full installation drawings and material requirement schedules, shall be submitted to and receive the approval of the Engineer before materials procurement or installation commences.

E. SOIL SURVEY

The preliminary tender design shall be based on a value of 100 ohm-m soil resistivity.

Not later than one month after the site has been handed over for access, the Contractor shall carry out an earth resistivity survey of the sites and report in writing to the Engineer in accordance with the approved program. The report shall detail the methods and instruments used and the results of the surveys. Based on the results the Contractor shall include in the report his proposal for the resistiveties to be used in the design of the earthing system.

The surveys shall show the variation of resistivity across the site and with the depth below the site. The Contractor shall consider if there is a need to model the resistivity in two layers and if there is any advantage in the use of deep rod electrodes.

The surveys shall also determine the depth and nature of any underlying rock, which may limit the depth for driving earth rods or if boring will be necessary for installing earth rods.

The weather conditions prior to and at the time of the surveys shall be recorded in the report and an assessment made of the seasonal variations in resistivity based on meteorological data for the area. The program for the project should, as far as possible, time the resistivity surveys to take place during a dry season.

The report should also state if there are any indications that the ground is corrosive to bare copper.

The report shall be approved by the Engineer before proceeding with the design of the earthing

F. FAULT CURRENT AND DURATION

Each site shall be provided with an earth grid of buried conductors designed for an earth fault current of **31.5 KA** for three second. The preliminary earthing, design shall be such that the ground potential rise shall not exceed 2 kV.

G. EARTH ELECTRODE SYSTEM DESIGN

i) Design Calculations

The design of the earth electrode systems shall be based on the approved earth resistivity data and the system fault currents and their duration.

The design calculations in detail shall be submitted for approval of the Engineer and shall be based on the methods given in the standards listed. The calculations shall include the following parameters:-

(a) earth resistance of the whole system and of its components.
(b) earth potential rise
(c) step, touch and mesh potentials inside and outside the perimeter fence
(d) requirements for a high resistance surface layer
(e) conductor ratings

Earthing points shall be provided such that the combined resistance of the earth grid and all other earthing points does not exceed 0.5 ohm during the dry season.

The earth potential rises shall not exceed the CHIT limits appropriate to the classification of the system unless special precautions are taken to cater for transferred potentials.

Step, touch and mesh potentials shall be within the permitted limits calculated in accordance with the standards given in IEEE 80 for the proposed surface layer.

ii) Earth Electrode

The earth electrode shall comprise a system of bare copper conductors forming a mesh buried near the surface of the ground and supplemented, if required, by one or more of the following electrodes:-

(a) a system of interconnected rods driven into the ground.
(b) a mesh system of bare conductors buried in the ground.
(c) structural metal work in direct contact with the ground.
(d) reinforcing steel in buried concrete.
(e) a system of bare conductors buried near the surface of the ground outside the perimeter fence.

iii) Mesh System

The mesh system shall be designed with above to limit touch, step and mesh potentials taking into account the combined length of the mesh conductors, other buried conductors and rods but excluding any buried conductors outside the perimeter fence. Due regard shall be given to non-linear distribution of the fault current giving rise to the highest potentials at mesh corners.

The rating of the mesh conductors shall be compatible with the fault currents after allowing for parallel paths of hard drawn high conductivity copper strip with a minimum conductor size of 200 mm^2.

The conductor shall be installed in trenches excavated by the contractor at a minimum depth of 1000 mm. The system will be installed after all foundations have been laid and the site filled to 100 mm below finished level. When the earthing grid has been laid and back filled, bricks will be laid up to finished site level. Where the excavated material is rocky or may be difficult to consolidate, the back filling shall be carried out using other material to the approval of the Engineer. The cost of such material shall be deemed to be included in the Contract.

iv) Interconnected Rods

If the design calculations show that a mesh alone is unable to limit the required values, then the mesh shall be supplemented by the use of interconnected copper earthing rods driven into the ground or

installed in bored holes.

Rods shall be installed inside the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. (The spacing between rods shall not be less than their length, unless rating considerations determine otherwise). The copper rod electrodes of 15mm diameter shall be interconnected in groups of four to eight rods by insulated copper conductors and non-ferrous clamps to form a ring. Each group shall be connected to the mesh by duplicate insulated copper conductor via disconnecting test links.

Individual rods may be connected directly to the mesh, provided the rod can be disconnected for testing.

Rods installed in bored holes may be used to reach lower resistivity ground strata at depths beyond the reach of driven rods or where rock is encountered and it is not possible to drive rods. After installing the rod the bored hole shall be back-filled with a low resistivity liquid mixture, which shall not shrink after pouring, to ensure good contact between the rod and the ground for the life of the installation.

The resistance and rating of individual rods and the combined resistance of the groups of rods in the proposed design shall be calculated and the rating of the interconnecting conductors shall not be less than that of the group of rods with a minimum conductor size of 200 mm^2.

The calculation of potentials in the design of the complete installation shall be made without the group of rods with the lowest estimated resistance to simulate the condition with the group disconnected for testing.

v) Other Conductors

As an alternative to rods to supplement a mesh, additional bare copper conductors with a cross-section area of not less than 150mm^2 may be used. They shall be buried in the ground within the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. Such conductors may be laid below the mesh, below foundations or in areas where there is no plant. It shall be shown by calculation that the step potentials are low in such areas.

The conductor shall be in a ring, or a part of a ring, with at least two widely separated connections to the mesh or other parts of the earthing system.

vi) Reinforcing Steel

The reinforcing steel in the foundations of buildings containing the primary electrical equipment may be used as auxiliary electrodes, subject to the approval of the Engineer. The contractor shall show in the design calculations that the fault currents and d/c stray currents will not damage the structure.

Steel reinforcing mesh in the floors of the building may also be used for the control of step and touch potentials within the building subject to approval of the Engineer.

vii) Conductors Outside Perimeter Fence

If the design calculations show that the step and touch potentials outside the perimeter fence or wall exceed the limits, than additional bare conductors shall be buried in the ground outside the fence in the form of rings encircling the whole site.

The distance of the conductors from the fence and the depth shall be determined in the design to ensure that step and touch potentials are within the limits.

The minimum conductor size shall be 75mm^2 copper and shall be connected to the fence or the mesh with 75mm^2 conductors at each corner of the site and at intervals of not more than 100m. These conductors shall not be included in the calculations called for above.

POWER TRANSFORMER NEUTRAL GROUNDING

Neutral of POWER TRANSFORMER seperately Grounded by 03(Three) Nos. of Electrode (round Bar) of 16 mm Dia with 04(Four) Meter Length Each and Length of the electrode will be decided as per Design calculation. From Transformer Neutral to Electrode Connection 300 sq-mm Copper Conductor will be used.

MATERIALS AND INSTALLATION

Description	Size
Mesh Conductor Cross Section Area	200 sq-mm(Min)
Dia & Length of Each electrode/Rod	16 mm & 04(Four) Meter
Total Length of the electrode & Mesh Conductor	as per Design calculation
Conductor for Neutral of Power Transformer	2x150 sq-mm(Min)

The size/type of earthing Riser/Connectors for different equipment shall be as follows:

1	Neutral of the Power Transformer 33/11kV	-not less than 2x150 mm^2 copper conductor with adequate insulation
2	Body of the Power Transformer, 33/11kV	- bare copper bar of not less than 120mm^2 for each power transformer 2 nos.
3	Neutral of the station transformer, 33/0.4 KV	- not less than 150 mm^2 copper conductor with adequate insulation
4	Body of the station transformer, 33/0.4 KV	- not less than 120 mm^2 Cu wire
5	33 KV PT LV Neutral	- 16 mm^2 Cu. Wire.
6	11 KV PT LV Neutral	- 16 mm^2 Cu wire
7	Steel mounting structure at the switchyard	- 120 mm^2 Cu wire for each steel mounting structure 2 nos.
8	Body of the indoor 33 KV switchgear Panel	- not less than 3x120 mm^2 Cu wire
9	Body of the indoor 11 KV switchyard Panel	- not less than 120 mm^2 Cu wire at minimum 2 points
10	Body of the Indoor control relay panel - 33/11 KV A.C. distribution panel. DC distribution panel, battery charger and other miscellaneous indoor equipment.	- 120 mm^2 Cu wire
11	33 KV Lightning Arrestor Outdoor	- not less than 120 mm^2 Cu wire at minimum 2 points

There shall be no inter-connection between earthing points of Power Transformers, LAs & substation main earthing mesh.

The earthing leads with appropriate thimble shall be connected to the welded flat bar earth electrode, by bolts & nuts.

The other ends of the earthing leads shall be connected to the equipment/chassis at appropriate terminals by using thimbles/connectors etc and nuts & bolts.

Appropriate earthing devices and arrangement shall be provided for all 33KV and 11KV switching

panels having provision for operation from the front.

H. DESIGN OF EARTH SYSTEM

i) Earth System

An earth system shall comprise the following components:-

(a) the conductors between the earth electrode system and the main earth bar
(b) the main earth bar
(c) the conductors between the main earth bar and the metallic frames, enclosures or supports of electrical equipment
(d) the conductors between structural metalwork and non-electrical equipment and the main earth bar

The rating of earth system conductors connected between an item of electrical plant and the earth electrode system shall be sufficient to withstand the fault currents and duration, after allowing for the parallel paths through the earth system conductors, with any one conductor disconnected.

The design comprising all the above mentioned items shall be submitted to the Engineer for approval within four months of the award of contract.

ii) Connection of the System Neutrals and Earth

The system neutral points within a substation shall be arranged in two groups with a conductor from earthing point.

The copper earth electrodes of a neutral earthing point shall be arranged in two groups with a conductor from each group to a test link and there shall be duplicate bare copper conductors of cross sectional area not less than 150 mm^2 from each test link to the earth grid. The duplicate connection may be in the form of a ring.

Neutral earthing connections between the substation system (transformer) neutral and the test links shall be of bare copper tape, secured and supported on stand-off insulators so that there is no contact between copper tape and transformer tank.

Neutral earthing conductors shall normally be buried directly in the ground but where necessary, they may be cleared to walls, fixed to cable racks or laid in the cable trenches.

iii) Main Earth Bar

The main coppper earth bar shall be in the form of a ring or rings of bare conductors surrounding, or within an area in which items to be earthed are located. Where two or more rings are installed, they shall be interconnected by at least two conductors which shall be widely separated.

The main earth bar, or parts thereof, may also form part of the earth electrode system, providing this is bare conductor.

Each main earth bar shall be connected by at least two widely separated conductors to the earth electrode system.

The minimum conductor size for the main earth and interconnections between earth bars and the earth electrode system shall not be less than 200 mm^2.

iv) Electrical Equipment Tank and Structure Connections to Earth

Connections between: (a) all HV electrical equipment and (b) LV electrical equipment comprising substantial multi-cubicle switchboards and the main earth bar shall be duplicated. The bare copper conductor size shall have a minimum cross section area of 150 mm^2.

All substation equipment, including disconnectors, earth switched, main transformer tanks, current and voltage transformer tanks, switchboards, electrical supporting steelwork and gantries etc. shall all be connected with the earth grid.

Surge Arresters installed for the protection of transformers and reactors shall be connected by low reactance paths both to the transformer tanks and to the earth grid.

Capacitor voltage transformers used in connection with line traps shall be connected by direct low reactance paths to a single earth rod for each Arrester, in addition to the earth grid.

An earth mat shall be installed at all operating positions for outdoor HV equipment manual operating mechanism boxes and local electrical control cubicles to ensure the safety of the operator. The mat shall be directly bonded to the cubicle and the conductors forming the mat and the bonding connection shall have a minimum copper cross-section area of 75 mm^2.

Galvanized structures comprising bolted lattice components shall not be used as the sole earth connection path to post and strain insulators or to overhead line earth conductors.

Buildings containing electrical equipment shall be provided, at each level, with a ring of earthing conductors which shall have duplicate connections to the earth grid outside the building. The frames of all switchgear, control and relay panels and other electrical equipment and exposed structural metal work shall be connected by branches to a ring. The ring and branch conductors shall be of the same material as the earth grid. Strip run within buildings, inside cable trenches or above ground level on apparatus shall be neatly supported on non-ferrous clamps.

Fixed earthing connectors for use with portable earthing devices below shall be provided on each bus bar and on both sides of high voltage equipment is by tubular bus bars.

Rigid loops in the copper earthing strip branch bond between the equipment and the earthing grid shall be provided adjacent to each item of high voltage equipment for use with the portable earthing devices. The rigid loops shall be marked green.

Connections between other LV electrical equipment and the earth bar need not be duplicated. The single conductor shall be rated to withstand the fault rating of the equipment.

v) Connections to Non-Electrical Structural Metalwork and Equipment

All metal work within the project area which does not form part of the electrical equipment shall be bonded to the main earth bar except where otherwise specified. The bonding conductor size shall be not less than 150 mm^2.

Individual components of metallic structures of plant shall be bonded to adjacent components to form an electrically continuous metallic path to the bonding conductor.

Small electrically isolated metallic components mounted on non-conducting building fabric need not be bonded to the main earth bar.

I. MATERIALS AND INSTALLATION

i) Conductors

Conductors shall be of high conductivity copper in the form of circular conductors stranded to IEC 228(BS 6360) or solid rods or bars to BS 1433.

Conductor sheaths shall be of PVC to meet the requirements of BS 6746 Grade TM1 or IEC 502 Grade ST1 with a minimum thickness of 1.5mm.

Buried conductors which are not part of the earth electrode system shall be PVC sheathed circular stranded cable.

Bare strip conductors only shall be used for earth electrodes or voltage control meshes.

Conductors buried in the ground shall normally be laid at a depth of 800 mm in an excavated trench. The back fill in the vicinity of the conductor shall be free of stones and the whole back fill shall be well consolidated. Conductors not forming part of a voltage control mesh shall be laid at the depth required by the approved design and in the case of a PVC sheathed conductor, at the same depth as any auxiliary power or control cables following the same route.

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

ii) Earth Rods

Earth rods shall be driven to a depth below the ground water table level, to be determined by the Contractor during soil investigation and survey of site.

The earth rods shall be of hard-drawn high conductivity copper with a diameter of not less than 15mm with hardened steel driving caps and tips. The rods should be as long as possible but couplings may be used to obtain the overall depth of driving required by the design.

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

If difficult driving conditions arising from hard or rocky ground are encountered or are anticipated or there is a need for deep rods, then high tensile steel rods shall be used. High tensile steel rods shall have a molecularly bounded high conductivity copper coating with a minimum radial thickness of not less than 0.25 mm. The overall diameter shall be not less than 12 mm. Rolled external screw threads shall be used on the rod for coupling and after rolling the thickness of the copper coating on the

threaded portion shall be not less than 0.05 mm.

Rods, driving caps and tips shall about at couplings to ensure that the couplings and screw threads are not subject to driving forces. All screw threads shall be fully shrouded at the couplings. Alternatively, conical couplings may be used to the approval of the Engineer.

High conductivity copper for earth rods shall have a minimum copper content (including silver) of 99.90% to ISO 1337, Cu-ETP or Cu-FRHS (BS 2894 Grade C 101 or C102) for copper earth rods and to ISO 1337 Grade Cu-ETP (BS 28734 Grade C 101) for the molecular bonded copper coating of steel rods.

The steel for copper-clad steel rods shall be low carbon steel with a tensile strength of not less than 570 N/mm^2 to ISO 630, Grade Fe 430A (BS 4360 Grade 43A) or better.

Couplings for copper rods shall be of 5% phosphor bronze (copper-tin-phosphorous) to ISO 427, CU Sn_4 (BS 2874, Grade PB 102M) and for copper bonded steel rods of 3% silicon or 7% aluminum bronze to BS 2874, Grade CS 101 and BS 2871, Grade CA 102.

iii) Fittings

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

Conductors shall be connected to earth rods by a bolted clamp to facilitate removal of the conductor for testing rod.

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

Disconnecting links mounted at ground level and the connections at the earth rods shall be enclosed in concrete inspection pits, with concrete lids, installed flush with the ground level.

All conductor fittings shall be manufactured from high strength copper alloys with phosphor bronze nuts, bolts, washers and screws. Binary brass copper alloys will not be acceptable. All fittings shall be designed for the specific application and shall not be permanently deformed when correctly installed.

Sheathed conductor support fittings may be of silicon aluminum, glass-filed nylon or other tough non-hygroscopic material for indoor installations.

Fittings not in direct contact with bare or sheathed conductors may be of hot-dip galvanized steel.
Bi-metallic connectors shall be sued between conductors of dissimilar materials and insulating material shall be interposed between metallic fittings and structures of dissimilar materials to prevent corrosion.

iv) Joints

Permanent joints shall be made by exothermic welding (Cad Welding) below ground, or crimping for above ground connections.

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

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

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

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

When the reinforcing in concrete is used as a part of the earthing system, the fittings used to provide a connection point at the surface of the concrete shall be exothermically welded to a reinforcing bar. This fitting shall be provided with a bolted connection for an earthing conductor. The main bars in the reinforcing shall be welded together at intervals to ensure electrical continuity throughout the reinforcing.

No connections shall be made to reinforcing bars and other steelwork which do not form part of the earthing system and are completely encased in concrete.

J. EARTHING OF FENCES

i) Method

Metallic fences shall be separately earthed unless they come within 1.8m of any equipment of structure above the surface of the ground and which is connected to the main earthing system. If the separation of 1.8m cannot be obtained, the fence shall be bonded to the main earthing system.

ii) Separately Earthed Fences

The earthing of a fence shall be provided by connecting certain metallic fence posts to an earth rod by a copper conductor. The earth rod shall be driven adjacent to the posts inside the fence line to a depth of not less than 3.0m. where no metallic posts are provided, the earth rods shall be connected directly to the metal wires, mesh or other components of the fence.

If, owing to the nature of the ground, it is not possible to drive earth rods, then fence posts shall be connected to the center point of a 20m length of bare copper conductor buried in the ground at a depth of 500mm, running closely parallel to the inside of the fence.

The earth rods or bare conductor electrodes shall be installed at each corner post, below the outer phase conductors of overhead line connections passing over the fence, at each gate and at intervals of not more than 100m.

iii) Bonded Fences

Fences which need to be bonded to the main earthing system of the installation shall be connected by copper conductors to the nearest accessible point on the main earthing system at each point where the fence comes within 1.8 m of any electrical equipment. Bonds shall also be made to each corner post,

below the outer phase conductors of overhead line connections passing over the fence at each gate and at intervals of not more than 100m.

iv) Bonding of Fence components

Fences made up bolted steel or other metallic component do not require bonding between components. Where such fences have non-metallic component, bonds shall be installed to maintain continuity between metallic components. Reinforced concrete components shall be treated as being non-metallic.

Longitudinal wires for supporting other fence component or for anti-climbing guards and the wires of chain link, shall be directly bonded to each electrode or to each bond to the main earthing system.

Metallic component on masonry, brick, concrete or similar boundary wall shall be treated in the same manner as metallic fences.
Wire fence component coated for anticorrosion protection shall be earthed inn accordance with this clause.

v) Gates

The fixed metallic components on both sides of the gate shall be directly bonded together by a copper conductor installed under the surface of the access way. Flexible conductors shall be installed to bond the moving parts of the gates to the metallic fixed parts. An earth rod or a bond to the main earthing system shall be installed at each gate.

iv) Potential Control Outside Fences

Where the approved design calculations show that the touch or step potentials outside the fence or boundary wall would otherwise be excessive, bare copper conductors shall be buried in the ground outside the fence or boundary wall at such depths and spacing as are shown in the approved design calculations to give acceptable touch and step potentials. The conductors shall form complete rings surrounding the installation and each ring shall be bonded to the adjacent ring and to the fence at each corner, below the outer phase conductors of overhead line connections passing over the fence at each gate and at intervals of not more than 100 m. In this case separate earth electrodes are not required for the fences.

If the boundary fence or wall is substantially non-metallic, the rings of conductors shall be bonded to the main earth system at each corner of the site and at intervals of not more than 100m. Any metallic components on such boundary fences or walls shall be bonded to the earthing system in accordance with this Specification.

If the boundary fence is metallic and is not within 1.8 m of any part of the main earthing system or equipment bonded thereto, the fence and outer conductor rings shall but be connected to the main earthing system unless the approved design calculations show otherwise.

Any meshes formed by bonding the outer conductors to he main earthing system shall be sub-divided by additional conductors, if required, to give acceptable touch, step and mesh potentials.

vii) Conductors

All conductors used for earthing and bonding the fences and components and for outer rings shall have a cross-sectional area of not less than 70 mm^2.

vii) Portable earthing devices

Portable earthing devices for use with outdoor 33KV apparatus in substations shall be supplied in the numbers stated in Schedule of Technical Requirements and shall comprise:

(a) Copper alloy earth end clamp for connection to the rigid loops in equipment earth bonding connections.
(b) Aluminum ally line and bus bar end clamp to suit the type supplied under the Contract.
(c) Flexible stranded aluminum alloy conductor with clear protective PVC sheath, size suitable for the specified fault level and duration.
(d) Telescopic operating pole of glass fibre or similar material, of sufficient length to reach the height of connections to high voltage equipment from ground, but retractable into a carrying length not exceeding 2.5m, and complete with non-slip hand grips.

K. SUB-STATION EARTHING AND EARTHING ERECTION

General earthing of all equipment shall be in accordance with the IEC recommendation No. 80 :1976-Guide for safety in alternating current sub-station Grounding, the British standard code of practice CP-1013: 1965 or other approved standard.

i) Earthing System

Each site shall be provided with an earth grid of buried copper strip conductors designed for an earth fault current of 31.5 KA for 3 seconds for all S/S. For the purpose of preliminary design it shall be assumed that the distribution of the fault current will be such that the ground potential rise of each site will not exceed 2 KV.

The preliminary design shall be based on clay silt having an assumed resistively of 100 ohm meters. Step and touch voltages both inside and outside the station shall not exceed 50 V.

The design of earth grid over the area occupied by switchgear and associated apparatus shall be based on a maximum grid spacing of 5m x 5m. Conductors shall be buried at 800mm depth.

Earthing points will be provided so that the combined resistance of the earth grid and earthing points shall be less than 0.5 ohm under dry climatic conditions.

The operating mechanisms of isolators, earth switches and circuit breaker kiosks not integral with the circuit breaker shall be connected to the earth system by a branch entirely separate from that employed to earth their bases. The branch is to be installed such that the connection would pass beneath where and operator would stand, so as to minimize step potential.

Fences shall be earthed independently of the sub-station grid.

Connections to plant and equipment shall be made using the earthing terminals specified in the contract where a strip has to be drilled to fit an earth terminals the diameter of the hole shall not be greater than ½ the width of the strip.

Joints in earthing strip shall employ chemical welding or high compression joints or clamps.

ii) Earthing Electrode

Each Earhting point shall consist of a group of copper rods drawn into undisturbed soil to a minimum depth of 4m. Each copper electrode shall be complete with approved non ferrous clamps for the connection of earthing conductors and with a hardened steel tip and cap for driving by means of a power hammer. The number of electrodes per group shall be not less than four and not more than eight, 16mm diameter rods and each copper electrode rod shall be 4 meter length and the number of rod groups per sub-station have been declared in the price schedule.

The electrodes of an earthing point will be arranged in two sub-groups with a conductor from each sub-group to the test link of the earth grid.

In addition to the above a single electrode is to be driven as close as possible and connected to the following :

i) Three phase set of surge diverts.
ii) Three phase set of voltage transformers.
iii) Three phase set of power transformers.
iv) The fence where an overhead line crosses at gates and at fence corners. The distance between electrodes is not to exceed 50 m.

Separate Earthing Electrode with special earth pit shall be provided for the following two items:
(i) Power Transformer neutral earthing
(ii) Lightning Arrester earthing

It has to be ensured that the earthing resistance of these separate earth electrode satisfies the basic requirement of earthing resistance.

iii) Insulated Earthing Conductors

Conductors for interconnection between the electrodes in any group and between groups and the connections between the link chambers and sub-station earthing main grid shall have twin conductors with a combined rating of 31.5 KA for three seconds for all S/S. The neutral points of the 11KV system shall be connected to the link chamber with twin conductors as above.

Earthing conductors shall be of annealed high conductivity copper and shall be stranded in accordance with IEC-228 table VII class-2. They shall be protected with an extruded PVC sheath of 100 volts grade.

iv) Sub-station Earthing Screen

Approved earth screens shall be provided to protect the equipment from direct lightning strikes. The screens shall be of the steel corned aluminum wires of not less than 35 Sq.mm total cross section and connected to provide low impedance paths to earth.

The layout of the earth wires shall be such that generally equipment to be protected lie within areas bounded by lines drawn from the earth wire at 35 degree to the vertical in a plane perpendicular to the axes of the earth wire. The earth screen shall be suitable for extension to protect the sub-station equipment to be installed in suitable stages of development.

Connections shall be made of copper strip of 150 Sq.mm cross section between each support for the overhead earthed screen wire and the main sub-station earthing system. Earth wires shall be held in

clamps with free pin type joints between clamps and supports connections shall be provided for the terminations of the earth wires of the overhead lines including bimetal connectors where necessary.

The necessary stays, fittings, anchors, flying stays and additional masts shall ensure clearance of not less than 4600 mm over roadways for circuit breaker or transformer removal. The design of all structures shall ensure that in the event of breakage of either one earth wire or one stay wire the factor or safety is not less than 1.5.

L. REQUIREMENT EARTHING

i) 11 kV Switchgear

All metal parts including any relay instrument etc. mounted on the switchboard shall be connected to a copper earth bar which runs along the full length of the switchboard.

The cross section to the bar shall be sufficient to carry the rated short time withstand current of the switchgear for three seconds.

The frame of the draw-out circuit breakers shall be connected to the earth bar through a substantial plug type contact.

ii) Low Voltage Switchboards

Earth metal of switchboards fuse and distribution boards and distribution boards shall be bonded together and earthed to the main sub-station earthing system. Earthing connections shall be carried out in bare copper strip having a 3 second rating not less than 31.5 kA for all S/S

iii) Control Panels

Each control panel shall be provided with a copper earth bar of not less than 80 Sq.mm cross-section and arranged so that the bars of adjacent panels can be joined together to from a common bus.

The common earthing bus bar of control and relay panels shall be connected to the main station earthing systems via a copper earthing connection of not less than 80 Sq.mm.

SECTION 7.4 TECHNICAL SPECIFICATIONS OF 33/11KV POWER TRANSFORMERS (20/26MVA, 16/20MVA) AND 33/0.415KV 250KVA STATION AUXILIARY TRANSFORMER

7.4.1 TECHNICAL SPECIFICATION OF 33/11 KV, 20/26.66MVA POWER TRANSFORMER

7.4.1.1 GENERAL

This section of the document includes the design, engineering, manufacture, supply, delivery, offloading, testing & inspection and performance requirements of 33/11KV, 20/26.66 MVAPower transformers and accessories as specified.

7.4.1.2 CLIMATE DATA

The distribution transformers to be supplied against this tender shall be suitable for satisfactory use under the following climatic condition:

Climate	:	Tropical, intense sunshine, heavy rain, humid.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average temperature	:	30^0 C
Relative Humidity	:	50-100%
Annual mean Relative Humidity	:	75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Maximum altitude above the sea level	:	Sea level to 300 metres
Atmospherically, Mechanical and Chemical impurities	:	Moderately polluted

The information is given solely as a guide for Tenders and no responsibility for its, accuracy will be accepted nor will any claim based on the above be entertained.
Transformer supplied under this contract will be installed in tropical locations that can be considered hostile to its proper operation. Particular problems that shall receive special consideration relate to operation in a hot environment and presence of the insects and vermin.

7.4.1.3 SYSTEM PARTICULARS

SL. NO.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, kV (Voltage Class)	230	132	33	11
3.	Maximum System Voltage, kV	245	145	36	12

4.	System Frequency, Hz	50	50	50	50
5.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
6.	Type of System Grounding	Solid	Solid	Solid	Solid
7.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	16000	6000	1800	500
8.	Basic Insulation Level, kV	750	650	170	75

High Voltage current carrying equipment should be capable of carrying the three phase fault level for a period of 3 Sec.

7.4.1.4 STANDARDS

The equipment specified in this Section of the contract shall conform to the latest edition of the appropriate IEC specifications and other recognized international standard. In particular:

IEC	60076-1	Power transformers (General).
IEC	60076-2	Power transformers (Temperature Rise).
IEC	60076-3	Power transformers (Insulation Levels, Dielectric Tests and External Clearance in air).
IEC	60076-5	Power transformers (Ability to Withstand short circuit)
IEC	60137	Bushings for alternating voltages above 1 kV.
IEC	60156	Method of determination of electrical strength of insulating oils .
IEC	60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC	60551	Measurement of transformer and reactor sound levels.
IEC	60616	Terminal and tapping markings for power transformers.
IEC	722	Guide to lightning and switching impulse testing of power transformers.
IEC	5493	Protective coating of iron and steel structures against corrosion.
IEC	551	Noise and Vibration of power transformer.

7.4.1.5 Technical Specification:

1.	Rated MVA (ONAN/ONAF)	20/26.66MVA
2.	Number of Phases	3 (Three)
3.	Frequency	50 Hz
4.	Winding Insulation	Uniform
5.	Normal Transformation Ratio at No-load and principal tap	33/11.55 KV
6.	Rated HT Voltage (Phase to Phase)	33 KV
7.	Maximum HT Voltage (Phase to Phase)	36 KV
8.	Rated LT Voltage (Phase to Phase)	11.55 KV
9.	Maximum LT Voltage (Phase to Phase)	12 KV

10.	Rated Current HT (ONAN/ONAF)	350/ 467 Amps
11.	Rated Current LT (ONAN/ONAF)	1050/1397 Amps
12.	Basic Insulation Level : a) High voltage winding b) Low voltage winding	 170 KV 75 KV
13.	Installation	Outdoor, Tropical, High rainfall & Humidity.
14.	Type	Core, Conservator & Oil Immersed
15.	Type of Windings	Double Wound of Electrolytic Copper, free from burs and splinter.
16.	Type of Cooling	ONAN/ ONAF
17.	Coolant	Type- A,Unused insulating mineral oil, free from PCB (polychlorinated biphenyl)
18.	Type of System Earthing	Effectively Earthed
19.	Bushing Material	Porcelain
20.	Type of Base	On wheels with adequate size and 10 M length of rails and fixing arrangement.
21.	Direction of Normal Power Flow	HT-LT
22.	Phase connection :(Δ -Y) a) 33 KV winding with bushing CT b) 11 KV winding with bushing CT	 Delta Star
23.	Vector Group	Dyn11
24.	Neutral to be brought out : a) HT b) LT	 Nil Yes
25.	Neutral Insulation	Full uniform insulation and 100% loading capacity
26.	Maximum Temperature rise over 40^0C ambient at full load & tap change is at normal position : a) Winding by Resistance (^{0}C) b) Oil by Thermometer (^{0}C)	 65^0C 55 ^{0}C
27.	Impulse Front Wave Test Voltage (1.2/50 Micro Sec. Wave Shape) : a) High voltage side b) Low voltage Side	 170 KV 75 KV
28.	Power Frequency withstand Test Voltage for 1 (one) Minute : a) High voltage side b) Low voltage Side	 70 KV 28 KV
29.	Impedance Voltage at 75^0C, at normal ratio and rated frequency, and at	8.5%

	ONAN condition.	
30.	**Type of tap changer control**	
	Features	The tap changer will be on load auto regulation, remote control and manual. The on load tap changer will immersed in the transformer tank. The diverter switch compartment will be provided with its own oil conservator which, will not be connected to the transformer oil tank. The diverter switch can easily be lifted out of its tank for maintenance and inspection without opening the transformer cover. The on load tap changer will operate by means of a motor drive unit. This unit will install on the side of the transformer.
		OLTC shall be operational from Local control panel, RTCC panel as well as from SAS. Tap position shall also be visible in Local control panel, RTCC panel as well as HMI of SAS. AVR relay shall have IEC-61850 communication protocol for communicating with SAS.
	On Load Tap changer with motor drive unit manufacturer's name & country	MR, Germany/ABB, Sweden.
	Tapping Range : a) HT b) LT	 17 Tapping ± 10% in steps of 1.25% i.e. 33 KV ± 8 x 1.25% Nil
31.	Bushing CT for differential protection	600/5A on HV, 1800/5A on LV of accuracy class 5P20, burden 30 VA.
32.	Neutral Bushing CT for Standby Earth Fault (SEF) & Restricted Earth Fault (REF) protection	1800/5-5Aon LV neutral of accuracy class 5P20, burden 30 VA.
33.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.
34.	**Transformer Oil**	
	Application	Insulating mineral oil for Transformer It will be free from PCB (polychlorinated biphenyl)

	Grade of oil	Type-A
	PHYSICAL PROPERTIES	
	Appearance	Liquid and free from suspended matter or sediment
	Density at 20^0 C	0.895 g/cm^3 (maximum)
	Flash point (Closed cup)	140^0 C (minimum)
	Kinematics Viscosity at -15^0 C	800 c St. (Maximum)
	Kinematics Viscosity at 20^0 C	40 c St. (Maximum)
	Pour point	-30^0 C (maximum)
	ELECTRICAL PROPERTIES	
	Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	New untreated oil, shall go through filtration treatment before the oil are introduce into the apparatus or equipment. The break down voltage of this oil shall be at least 50KV.
	Loss tangent/Dielectric dissipation factor at temp. 90^0 C, stress 500V/mm to 1000 v/mm and frequency 40 Hz to 62 Hz.	0.05 (maximum)
	CHEMICAL PROPERTIES	
	Neutralization value	0.3 mg KOH/g (maximum)
	Neutralization value after oxidation	0.40 mg KOH/g (maximum)
	Total sludge after oxidation	0.05% weight (maximum)
	PCB Content	Free from PCB
	STANDARDS	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148: 1972, IEC-60296 or latest revision there on.
35.	**FEATURES & ACCESSORIES OF TRANSFORMER:**	

	a) Bushing Insulator on HT and LT. b) Arcing horns on HT and LT bushings. c) Remote Tap Changer Control (RTCC) facility in Transformer HT incoming PCM Panel. d) Oil conservator. e) Buchholz relays in main conservator oil pipe. f) Tap Changer Protective Relay in between conservative and tap changer oil pipe. g) Conservator drain valve, breather and oil level gauge with alarm contact. h) Pressure Relief Device (PRD). i) Dial type thermometers with alarm and trip contracts. j) CT for winding temperature shall be located at mid-phase (Y-phase) of the transformer. k) Radiators with valves. l) Bladder/Airbag in conservator to separate air from oil. m) One inspection hole with cover. n) Facilities for lifting cover and coil assembly from tank. o) Lifting lugs for lifting complete Transformer. p) Base designed for rollers with bi-directional flanged rollers parallel to either Centre line. q) Tank oil sampling, draining valve and oil centrifuging outlets. r) Tank earthing points. s) Fans for forced cooling (ONAF). t) All mounting accessories including rails (2 Nos. rails each 10 Meter long). u) All equipment should be fully tropicalized. v) Painting to approved colour and shade. w) Rating nameplate and diagram plate of stainless steel having engraved letters filled with black enamel paint.

	x) The oil shall be supplied/ delivered in non-returnable sealed containers/ drums. y) The oil shall be fresh, unused, cleaned and free from suspended matter or sediment. z) The test shall be carried out on the oil as to be supplied without drying and degassing. aa) Uninhibited oils must not contain anti-oxidant additives. bb) Laminated, detailed Schematic Diagram of Control Circuit of Transformer & Tap changer inside Marshalling kiosk. cc) Dehydrating Silica-gel breather. dd) Air release plug. ee) Earthing terminals with lugs. ff) Thermometer pockets. gg) Winding temperature indicator with two contacts hh) Bottom mounting channel for 20/26.66MVA ii) Operation and maintenance manual along with troubleshooting procedure and installation guideline/manual shall be supplied with each transformer.
36	Transformers shall be provided with cable boxes for both HV and LV terminals to enable cable connection directly. Cable boxes shall be completed with all necessary fittings in which primary and the secondary bushings shall preferably be of horizontal orientation to ease the cable termination. Cable boxes shall be adequate proportions and designed in accordance with BS6435 or relevant other international standard in such a manner that they can be opened for inspection without disturbing the gland plate or incoming cables(s). Provision for connection of two cables per phase shall be provided. Cable boxes shall be designed for ease of access for joiting and connecting the cable. They shall be constructed to minimize the danger of fragmentation; cast iron boxes shall not be used. Disconnecting links shall be provided in the boxes to facilitate testing of the transformer and cables independently. The Cable boxes shall be of such a design as to prevent ingress of moisture. The Contractor shall guarantee (test certificates shall be supplied as proof) that the air clearances and the creep age path on the bushing connecting to the transformers shall be such that the completed installation shall withstand in air the impulse and power frequency test voltages.
36	**Following instructions to be followed for Submission of Test reports & Calculation during drawing approval:**
	aa) All Type test Report and related routine test report shall be of same transformer of same name plate serial no. bb) Calculation of load loss shall be provided for load loss in all 3(three) tap position (Nominal, Maximum, Minimum).

7.4.1.**6 A. INFORMATION REQUIRED**

The Tenderer/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information/Documents have to be submitted along with the tender:-

(a) The Tenderer/Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

(c) Construction, Installation, Operation & Maintenance Manual.

B. DOCUMENTATION:

The following documents must be submitted along with the tender, without which the tender shall be considered as non-responsive.

1. Filled up Guaranteed Technical Particular (GTP) of the offered equipment.
2. (a) Letter of authorization for Power Transformer from the Manufacturer, in case, the Bidder is not the manufacturer, in prescribed Form;
   (b) Manufacturer's authorization for (On Load tap Changer) OLTC from MR, Germany/ ABB, Sweden in prescribed Form;
3. (a) At least 02 (two) nos. of Manufacturer's Supply Experience for offered type similar or higher capacity rating Power Transformer of same voltage class within the last 05 (five) years i.e. years counting backward from the date of publication of IFT in the newspaper. The Supply Experience covering at least 25% of the Tendered quantity in a single Contract will be considered only.
   Manufacturer's supply experience (supported by copy of Contract Agreement and Certificate from purchaser) shall be furnished in the following format:

Sl. No.	Name, Address, Phone & Fax No. of the Purchaser	Contract No. & Date/NOA	Contract Value	Description of materials with Quantity	Date of Completion of Supply

(b) At least 02 (two) nos. Manufacturer's Satisfactory Performance Certificates (supported by the Supply Record) from Electricity Utility as End User depicting that the offered type similar or higher capacity rating Power Transformer of same voltage class has been supplied within last 10(ten) years i.e. years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 02(two) years. The Satisfactory Performance Certificate (SPC) shall be in End User's official pad and shall contain end-user's full mailing address, e-mail address, website address and fax/telephone number for the convenience of authentication.

(c) The following provision will be applicable for purchasing less or equal to 10 (Ten) nos. of 33/11kV, 20/26.66MVA Power Transformer from new local manufacturers:

i. At least 02(two) nos. of Manufacturer's Supply Experience for offered type similar or higher capacity rating Power Transformer of same voltage class within the last5 (Five) years; years counting backward from the date of publication of Invitation for Tender (IFT) in the newspaper. The Supply Experience covering at least 5% of the Tendered quantity in a single Contract will be considered only.

Manufacturer's supply experience (supported by copy of Contract Agreement/ Work Order /Certificate from purchaser) shall be furnished in the following format:

Sl. No.	Name, Address, Phone No. E-mail & Fax No. of the Purchaser	Contract No. & Date	Contract Value	Description of material with Quantity	Date of completion of supply
1.					
2.					

ii. At least 02 (Two) nos. of Manufacturer's Satisfactory Performance Certificates (supported by the supply record) from public/private organization as End User depicting that the offered type similar or higher capacity rating Power Transformer of same voltage class has been supplied within last 10 (ten) years; years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 02 (two) year. The Satisfactory Performance Certificate(s) shall be in End User's official pad and shall contain End User's full mailing address, e-mail address, website address, fax/telephone number for the convenience of authentication.

iii. The New Manufacturer shall submit the following document with the Tender document:

a) Location of the Factory & layout plan.
b) List of Capital Machineries (Related to manufacturer of the Tendered goods).
c) Factory Project Profile
d) Production Line description.
e) List of Key Personnel (with Bio-data).
f) Source of raw materials.
g) Testing facilities & calibration certificates of testing equipment.

iv. New Local Manufacturer's factory/manufacturing plant shall be inspected by the Tender Evaluation Committee (TEC) and/or TEC nominated members, to assess the New Manufacturer's production capability and will submit a report regarding Technical and Financial aspect in comparison to the information and document furnished by Tenderer. If the assessment report is not satisfactory, the related tender proposal of the tenderer will be considered as Non-Responsive.

All costs regarding visiting & inspection shall be borne by the New Manufacturer.

Factory shall be inspected by Tender Evaluation Committee (TEC) and/or TEC nominated members as per following guide lines:

1. Location of the Factory & layout plan.
2. List of Capital Machineries (Related to manufacturer of the Tendered goods)
3. Factory Project Profile
4. Production Capacity (Yearly)
5. Production Line description.
6. List of Key Personnel (with Bio-data)
7. Testing Facilities as per IEC 60076 there on.
8. Source of raw materials.
9. A sample of the offered type Power Transformer shall be tested during factory inspection at manufacturer's testing laboratory.

All other clauses of the specification and Guaranteed Technical Particulars (GTP) except Supply record & Performance Certificate (Clause no. 3 (a) & 3(b)) shall be applicable for tender Submission and Evaluation.

4. Cross-sectional Drawing showing the arrangement of core and windings of the offered type Transformer.

5. Type Test Certificates, Reports & Special Tests for offered type similar MVA rating power transformer for Type Test Certificates, Reports & Special Tests for offered capacity MVA rating power transformer for same voltage class from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory or from their authorized Laboratories as per relevant IEC standard. The type test report shall include at least the following tests along with results:
   a) Temperature Rise Test
   b) Lightning Impulse Test
   c) Short circuit withstands test report of HV-LV

   The Type Test Certificates, Reports & Special Tests of higher capacity MVA rating for same voltage class power transformer shall also be acceptable for evaluation purpose only. However the prospective tenderer(Contractor) shall have to confirm satisfactory Type Test Certificates, Reports & Special Tests of offered capacity MVA Rating power transformer for same voltage class prior to pre Delivery Inspection from above mentioned laboratories with mentioned Tests at least. All cost related to these tests shall be borne by the contractor.

6. Loss calculation, short circuit calculation and temperature rise calculation. Tenderer's quoted No load Loss and Full load loss shall be supported by loss calculation. Moreover, Tenderer shall submit the characteristic curve (flux vs Loss/Kg) of core materials.

7.4.1.7 CAPITALIZED COST:

Bidder shall declare guaranteed No Load Loss and Full Load Loss value in GTP. Any Tenderer quoted the No Load Loss & Full Load Loss above the upper limit of the loss as

mentioned in GTP (Section 8, Clause 8.01, Sl No.3.9) in Tender Document will not be considered for further evaluation & treated as non- responsive. The Tenderer who will quote the No Load Loss & Full Load Loss below the lower limit of No Load Loss & Full Load Loss as mentioned in GTP (Section 8, Clause 8.01, Sl No.3.9) In that case during evaluation Capitalization cost will be calculated only on the basis of the lower limit of No Load Loss & Full Load Loss. Tenderers quoted No load Loss and Full load loss shall be supported by test reports from independent testing laboratory. In case of difference between the loss value declared in the offer and the loss value to be found in the type test report, the higher loss value will be taken into account for the purpose of loss capitalization.

The fixed and running losses are to be low as consistent with reliable and economical use of materials. The cost of losses is to be minimized and the following capitalized parameters will be used in the evaluation of the transformer:

$C = 68{,}706 \times e \times P_0 + 54{,}964 \times e \times P_{FL}$

Where,

- C = Capitalized cost of transformer loss in Bangladesh Taka.
- e = Energy Cost, Tk. 6.00/KWh
- P_{FL} = Full Load losses at rated voltage, normal ratio and rated frequency in ONAF condition at 75^0C in KW + Auxiliary loss in KW
- P_0 = No load losses at rated voltage, normal ratio and rated frequency in KW

The cost of energy (C) will be added to the quoted prices to arrive at the evaluated cost of the transformer.

The contract will be cancelled if losses exceed the guaranteed value by an amount in excess of followings:

Total losses : 10%

Component : 15% of each component loss (Unless the total losses exceeds 10%).

7.4.1.8 SHIPPING:

All the delicate components shall be dismantled and packed in strong wooden boxes having inside lined with metallic sheets with proper sealing to protect the content from accidental direct exposure to weather during storage. The holes of the transformer tank shall be sealed with proper metal plate and gaskets to prevent leakage of oil and its contamination with atmospheric moisture. The transformer shall be shipped with radiators, busing conservator etc. dismantled but the tank filled with oil. The transformer oil from radiators and conservator shall be shipped in non-returnable drums. The bushing shall be shipped in oil sealed containers to avoid moisture absorption during shipment and storage. Oil shall be complying with IEC-60296.

7.4.1.9 The bushings shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size & shall be suitable for bimetallic

connection. The insulation class of the high voltage neutral bushing shall be properly coordinated with the insulation class, of the high voltage winding. Each bushing shall be so coordinated with the transformer insulation so that all flash over will occur outside the tank. All main winding and neutral leads shall be brought out through "out door" type bushings which shall be so located that the full flashover strength will be utilized and the adequate phase clearance shall realised. All porcelain used in bushings shall be of the wet process, homogeneous and free from cavities or other flaws. The glazing shall be uniform in colour and free from blisters, burrs and other defects.

7.4.1.10 HT BUSHING:

Provide 3 porcelain outdoor type, oil filled, impulse tested bushing with arcing horns of standard gap and bolted type terminal connectors, with head shrink rubber insulated cap suitable for connection to the incomes leads of ACSR Grosbeak (636 MCM) conductor.

7.4.1.11 LT BUSHING:

Provide 4 porcelain outdoor type bushing with bolted type connectors, suitable for connection to outgoing leads of one numbers of 500 Sq.mm XLPE, single core copper conductors per phase and suitable for head shrink termination.

7.4.1.12 FAULT CONDITIONS:

The transformer shall be capable of withstanding, on any tapping, for three seconds without damage an external short circuit between phases. The transformer winding shall be capable of withstanding for three seconds without damage a short circuit between one phase and earth with the neutral of the transformer directly earthed. For the purposes of this clause a fault level of 1800 MVA at the transformer 33KV terminals shall be assumed.

Evidence shall be submitted with the Tender as to the extent to which the manufacturer has provided or is able to prove either by calculation or test the ability of the specified transformers to withstand on any tapping, without damage under service conditions, the terminal and dynamic effects of external short circuit.

The Bid shall state tin the Technical Schedule a brief description of those transformers or parts thereof, which have been subjected to short circuit tests or for which short circuit calculations are available. It is preferred that this information relates to designs comparable with the transformers bidder but in the event this is not so the Engineer reserves the right to require calculating to prove that the design of transformers tendered will satisfactorily comply with this clause : such calculations being in accordance with the latest revision of IEC/ BS standard.

7.4.1.13 NOISE:

Vibration and noise levels of all transformers and auxiliary plant shall be in accordance with the IEC 551 and its latest version. The contract price shall include noise level tests to be carried out on one transformer.

7.4.1.14 HARMONIC SUPPRESSION:

Transformer shall be designed with particular attention to the suppression of harmonic voltages especially the third and fifth harmonics and to minimize the detrimental effects resulting there from.

7.4.1.15 **IMPEDANCE AND REGULATION**:

The Bidder shall be state in the Technical Schedules guaranteed values of impedance measured on normal and extreme tapping and the voltage regulation from no load to CMR at unity power factor and at 0.9 lagging power factor with constant voltage across the higher voltage windings.

7.4.1.16 **MAGNETIC CIRCUIT:**

The design of the magnetic circuit shall be such as to avoid static discharge development of short circuit paths internally or to the earthed clamping structure and the production of flux components normal to the plane of the laminations. Each lamination shall be insulated with a material stable under the action of pressure and hot oil.

The winding structure and major insulation shall be designed to permit an unobstructed flow of cooling oil through core cooling oil ducts to ensure efficient core cooling.

The magnetic circuit shall be insulated from all structural parts and shall be capable of withstanding a test voltage to core bolts and to the frame of 2000 volts rms for one minute.

7.4.1.17 FLUX DENSITY:

Cores shall constructed from clod rolled grain oriented steel sheets. Provided the contractor can provide adequate evidence that there will be no adverse effects due to stray flux heating of core with the quality of steel employed, designs may be offered such that when operating under the most onerous conditions, flux density in any part of the magnetic circuit does not exceed 1.7 Tesla.

The Contractor shall determine the operating conditions under which the maximum flux density will be attained within the following simultaneously applied limits.

- Frequency : 50 Hz
- LV and HV Voltage : Up to but not exceeding the specified maximum System voltage.
- Load : The transformer may be subjected to intermittent overloading of 150% rated MVA at 0.8 power factor lagging in accordance with IEC-60035.

The maximum flux densities anticipated under these conditions are to be stated in Technical Schedules (GTP).

7.4.1.18 WINDINGS:

a) The windings shall be of high-conductivity electrolytic copper.
b) The transformer windings shall have uniform insulation as defined in the latest revision of IEC standard. The insulation of the coils shall be such as to develop the full electrical strength of the windings. All materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil, and shall not soften or otherwise be adversely affected under the operating conditions.
c) The transformers shall be designed to withstand the impulse voltage levels and the power frequency voltage tests specified in the Technical Schedules.
d) The winding shall be located in a manner which will ensure and that they remain Electro-statically balanced and that their magnetic centers remain coincident under all conditions of operation.
e) The winding shall also be thoroughly seasoned during manufacture by the application of axial pressure at a high temperature for such length of time as will ensure that further shrinkage is unlikely to occur in service.
f) All electrical connections within windings shall be brazed to withstand the shocks, which may occur through rough handling and vibration during transport switching and other transient service conditions.
g) Coil clamping rings shall be of the on on-magnetic steel or insulating materials built up from flat laminations. Auxiliary laminated material other then Bakelite paper is not to be used. Where Bakelite paper rings are used with the layers of paper lying in the axial direction, the rings may be relied upon to provide the major insulation between the windings and frame subject to there being adequate creepage distance. Any metal pieces in contact with laminated rings shall be designed and secured so that they do not weaken the electrical or the mechanical properties of the rings. If the winding is built up of section or of disc-coils separated by spacers, the clamping arrangement shall be ensure that equal pressure are applied to all columns of spacers.
h) The winding shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs can be readily done, without special equipment. The coils shall be supported between adjacent sections by insulating spacers and the barriers, bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot sports in the windings. The insulation paper shall be of high quality and the value of degree of polymerization shall not be less than 1200 dp and the necessary test certificate shall be submitted along with the Pre –delivery inspection report. Provision shall be made in the tank, for taking sample, in future, of paper for testing purpose and location shall be easily accessible and indicated on the transformer tank by affixing special caution plate.

7.4.1.19 INTERNAL EARTHING ARRANGEMENT:

All metal parts of the transformer with the exception of the individual core lamination, core bolts
and associated individual clamping plates, shall be maintained at some fixed potential.
The top main core clamping structure shall be connected to the tank body by a copper strap and the bottom main core clamping structure shall be earthen by one or more of the following methods:

- by connection through vertical tie rods to the top structure.
- by direct metal-to-metal contact with the tank base maintained by the weight of the core and windings.
- by connection to the top structure on the same side of the core as the main earth connection to the tank.

The magnetic circuit shall be earthed to the clamping structure at one point through a removable link placed in an accessible position just beneath an inspection opening in the tank cover and which, by disconnection, will enable the insulation between the core and clamping plates, etc. to be tested at voltages up to 2 KV for the purpose of checking deterioration during service. The connection to the link shall be on the same side of the core as the main earth connection. These requirements are mandatory.
Magnetic circuits having an insulated sectional construction shall be provided with a separate link for each individual section and the arrangement of the connections shall be subject to the approval of the Engineer.

Where oil ducts or insulated barriers parallel to the plane the laminations divide the magnetic circuits into two or more electrically separates parts, the ducts and insolating barriers which have the thickness greater than 0.25, mm are to be bridged with tinned copper strips so inserted as to maintain electrical continuity.
Where coil-clamping rings are of metal at each potential, each rings shall be connected to the adjacent core clamping structure on the same side of the transformer as the main earthing connection.

Main earthing connections shall be a cross-sectional area of not less than 100mm2 but connections inserted between laminations may have cross sectional areas reduced 20mm2 when in close thermal contact with the core.

7.4.1.20 CORE

The core shall be constructed from high grade cold rolled non-ageing grain oriented silicon steel laminations, M4 or Superior Grade. Only prime quality CRGO sheets should be used in the transformers and no Second/Defective/Scrap CRGO finds way into transformers. Therefore regarding quality control following documents are to be furnished with the Post – delivery inspection report.

1. Invoices of supplier
2. Mill's test certificate
3. Packing list.
4. Bill of lading
5. Bill of entry certificate by custom
6. Description of material, electrical analysis, Physical inspection, certificate for surface defects, thickness and width of the material.

It is to note that, using seconds/defective CRGO sheets or load losses found to be more than stipulated limit, heavy penalty will be imposed or the suppliers will be black listed.

7.4.1.21 TRANSFORMER TANK

The Transformer Tank shall be welded construction fabricated from high tensile steel plate and shall be designed to withstand full vacuum. The transformer shall have air seal type oil conservator tank at the top.

a) The transformer tank and cover shall be fabricated from good commercial grade low carbon steel suitable for welding and of adequate thickness.
b) The transformers tank shall be capable of withstanding full vacuum without deflection.
c) The plates (tank & Cover) shall have the following minimum thickness.

Length of Transformer Tank	Minimum Thickness	
	Side Plates	Bottom Plates
Less than 2500 mm	Min 6 mm	Min 9 mm
Greater than 2500 mm	Min 9 mm	Min 12 mm

d) The base of each track shall be so designed that it is possible to move the complete transformer unit in any direction without injury when using rollers, plates or rails. A design, which required that slide rails be placed in a particular position, is not to be used. 20/26.66 MVA and lower rate transformers shall be provided with base plates having bi-directional wheels for placing on rails.
e) An inspection window with a welded flange & a bolted cover shall be provided on the tank cover. The manhole shall be of a sufficient size to ease access to the lower ends of the bushings, terminals etc.
f) Lifting eyes or lugs shall be provided on all parts of the transformers requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank for lifting the transformers either by crane or by jacks. The design of the tank, the lifting lugs and bosses shall be such that the complete transformer assembly filled with oil can be lifted with the use of those lugs without any damage or distortions.
g) The tank shall be provided with two suitable copper alloy or any other suitable material lugs for the purpose of grounding.

h) The tank shall be so designed that with the cores and windings in position there shall be no possibility of air or gas being trapped when filling the tank with oil. Likewise, water shall not be trapped on the exterior of the tank.
i) The tank shall be fitted with pockets for a thermometer and the bulb of a winding temperature indicator and an oil temperature indicator.
j) Necessary drain valves, filter valves, vales to take oil sample etc shall be provided.

7.4.1.21.1 Conservator Tank

A conservator tank shall be mounted above the highest point of the oil circulating system of the equipment. Tanks shall be formed of substantial steel plate. Connections between the main tank and the conservator shall be such that air or gas is not entrapped and the Buchholz relays can be correctly installed. One end of the conservator shall be fixed by bolts so that it can be removed to enable the tank to be cleaned. The capacity of each conservator tank shall be adequate to accommodate the expansion and contraction of oil in the whole system, over the extreme range possible in operation, i.e. equipment unenergised in an ambient temperature of 5 deg. C to the condition corresponding to maximum oil temperature rise. Conservator shall be fitted with:-

(a) A hydro compensator for separating oil and air. A dehydrating breather shall be used for the air intake of the hydro compensator. Alarm for leak of the hydro compensator shall also be provided.

(b) At least one magnetic oil level indicator type visible from ground level and indicating the oil levels over the range specified above. The oil level indicator shall be marked to indicate the correct oil level with the oil at a temperature of 5 deg. C, 30 Deg. C and 90 deg. C. The temperature markings shall preferably be integral with the level indicating device but subject to the approval of the Authority.

(c) Low oil alarm initiating device.

7.4.1.21.2 Pressure Relief Device

The transformer shall be fitted with a pressure relief device designed to protect the tank from damage and to control the expulsion of oil during an internal fault. The pressure relief device shall be of the spring-loaded diaphragm type capable of opening fully within two milliseconds of detecting an excess pressure, and shall fully reseal after release of the exceeded pressure. Corrosion resistant materials shall be used and a visual indication of operation shall be provided. Two pairs of normally open contacts and a suitable terminal box shall be provided for remote electrical indication and tripping.

7.4.1.21.3 Gaskets

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight.

7.4.1.22 Oil

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil after treatment in compliance with IEC 60296 & BS 148.

7.4.1.23 ACCESSORIES

7.4.1.23.1 Winding Temperature Indicator

The transformer shall be provided with a winding temperature indicator and combined alarm and trip relays of approved design. The alarm and trip settings shall be adjustable. The winding Temperature Indicator shall also be provided with additional contacts for automatic 'start/stop' of cooling plant (fans). It shall be fitted with dial indicator calibrated in degrees Celsius and fitted with a hand reset pointer the highest temperature attained. The winding temperature indicator shall be so mounted in the transformer marshalling kiosk so that the dial is not more than 1500 mm from ground level. The cover shall be equipped with a viewing aperture of adequate size, fitted with clear, reinforced glass.

7.4.1.23.2 Oil Temperature Indicators

The transformer shall be provided with an oil temperature indicator of approved design incorporating contacts and relay(s) for initiating alarms and trips. The indicator shall be fitted with a dial calibrated in degrees Celsius, with a hand reset pointer to register the highest temperature attained.
The oil temperature indicator shall be mounted in the transformer marshalling kiosk so that the dial is not more than 1500 mm from the ground level and the cover shall be equipped with viewing aperture of adequate size, fitted with clear, reinforced glass.

7.4.1.23.3 Buchholz relay

A Buchholz relay with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressures, complete with two shut-off valves and flange coupling to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and test valve shall be provided. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation & taking gas sample.

7.4.1.23.4 Breathers

Each transformer and tap changer conservator shall be provided with a silica gel breather complete with oil seal, oil level indication window and a sight glass for inspection of the silica gel. Due to the climatic conditions at site, this breather shall be liberally sized and one size larger than would be fitted for use in a temperate climate.

A visual indication of the extent to which the drying agent has absorbed moisture is preferred, showing how much active material remains effective.

Maintenance free breather shall have sensor controlled heating apparatus. The supply voltage shall be 230V AC. Adequate cable shall be provided to connect with marshalling box.

7.4.1.23.5 Padlocks

The supplier shall provide padlockable handles and non-ferrous padlocks with duplicate keys for tap changer control panel and kiosks door to prevent all unauthorized access and operation.

7.4.1.23.6 The other accessories shall be provided is listed below

a) Ladder permanently fixed with transformer tank

b) Dial Thermometer with pocket for oil temperature indicator with one set of alarm and one set of trip contacts and maximum reading pointer.

7.4.1.24 Marshalling Kiosk (box):

Marshalling box shall be connected at one side of transformer. It shall consist of WTI (winding temperature indicator) and OTI (oil temperature indicator), magnetic oil gauge and Buchholz relay and other control terminals. WTI are in two numbers, one for HV and other for LV. It shall also consist of all auxiliary contactors as required in the order to make necessary potential free contacts for remote alarm and tripping, a heater which is used to absorb the moisture in the box, SPN socket outlet, complete with switch and HRC fuse for hand lamp connection.

7.4.1.25 Painting

The minimum standards acceptable are :

a) cleaning by shot blasting to Grade Sa 2.5 of ISO 8501-1
b) All sheet steelwork shall be degreased, pickled and phsphated in accordance with IEC 60076.
c) Interior surface of mechanism chambers, boxes and kiosks, after preparation, cleaning and priming shall be painted with one coat of zinc chromate primer, one coat of phenolic based undercoating, followed by one coat of phenolic based finishing paint to white colour followed ba a final coat of anti-condensation white paint of a type and make to the approval of purchaser. A minimum overall paint film thickness of 150 micons shall be maintained throughout.
d) Exterior steel work and metalwork, after preparation and priming shall be painted with one coat od xinc chromate primer, one coat of phenolic based under coating and two coat of micaceous iron oxide paint, then painted with final coat of phenolic based hard gloss finishing paint of the light grey shade to provide an overall minimum paint thickness of 200 microns.

7.4.1.26 Galvanizing

All galvanizing shall be carried out by the hot dip process, in accordance with specification ISO 1460. However, high tensile steel nuts, bolts and spring washers shall

be electro galvanized. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be o impurities in the zinc or additivies to the galvanic bath which could have a detrimental effect on the durability of the zinc coating.

Before pickling, all welding, drilling, cutting, grinding etc must be complete and all grease, paint, varnish, oil, welding slag etc completely removed.

The weight of zinc deposited shall be in accordance with the staed in BS 729, ISO 1460 and shall be not less than 0.61Kg/sq. mtr. with minimum thickness of 86microns for items of thickness more than 5mm, 0.46Kg/sq.mtr. (64microns) for items thickness between 2mm and 5 mm and minimum 0.33kg/sqmm (47microns) for the item less than 2mm thick. Repair of galvanizing on site will generally not permitted.

7.4.1.27 Terminal marking

Each terminal including the neutral shall be clearly marked on both the primary and secondary side in accordance with the diagram of connection supplied with the transformers.

The terminal marking shall be clear and permanent. Painted markings are not acceptable. the winding shall be leveled as follows:

High voltage	:	3 phases	A B C
Low voltage	:	3 phases and neutral	a b c n

7.4.1.28 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of the capitalized cost of the Transformer losses.

b) Bidder will declared/ guaranteed No-Load loss and Full load loss value, otherwise the bid will be **rejected.**

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value, otherwise the bid will be **rejected.**

7.4.1.29 Acceptance criteria of transformer loss and percentage impedance during factory test:

Transformer will be tested during technical orientation & quality acceptance and will be accepted if the measured transformer losses are within the offered value or within the following tolerance with deduction of amount from the contract price as below:

i) Any component loss (No load loss or Full load loss) may exceed up to 15% of the offered component loss, provided that the total loss (No load loss + Full load loss) shall not exceed 10% of the offered total loss. If any component loss exceeds 15% of the offered component loss, the full consignment will be rejected.

ii) Total loss (No load loss + Full load loss) may exceed up to 10% of the offered total loss. If it exceeds 10%, the full consignment will be rejected.

iii) Percentage Impedance may vary up to ±10% of the specified value. If the value exceeds the tolerance (±10%), the full consignment will be rejected.

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the offered value or within the acceptable limit as specified in (i), (ii) and (iii) provided an amount will be deducted from the Contract price for the loss(s) exceeding the offered/declared loss(s) according to the following formula:-

Amount to be deducted from the Contract price

= Contract Price x {(Measured loss - Specified loss /declared loss) ÷ Specified loss/declared loss} X %MT

Where,

	Measured Loss (in KW)		Measured Average No load Loss* 1+ Measured Average Full Load Loss* 2.
	Offered Loss (in KW)		Offered No Load Loss + Offered Full load loss
	Transformer Economic Life		20 Years

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness by BPDB's inspection team whose measured loss(s) (No load loss or Full load loss or Both) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during QAT/pre-delivery inspection is 8, 6 nos. are found within the offered losses and 2 nos. are found exceeding the offered losses then the %MT will be (2/8)x100=25%

* 1Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered No-load loss ÷ Nos. of tested transformer(s) which exceeds the offered No-load loss]

* 2Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered Full-load loss ÷ Nos. of tested transformer(s) which exceeds the offered Full-load loss

7.4.1.30 Mandatory SPARE PARTS

As per Price Schedule.

7.4.1.31 Approval of Drawings

The supplier shall submit the following drawings in AutoCAD format and in hard copy for the approval of the purchaser within commencement period.

1. Full Technical Specification and Guaranteed Technical Particulars
2. Max. Temp. Rise of Winding & Oil over 40°C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.
3. General outline drawing showing front, side elevation and plan of the transformer and accessories with detailed dimensions. The clearances between HV and LV terminals and ground should also to be shown.
4. Drawings of each type of bushings, lifting dimensions, clearance between HT and LT terminals and ground, quantity of insulating oil, name plate details etc.

5. Large scale drawings of high and low-tension windings of the transformers showing the nature and arrangement of insulators and terminal connections.
6. Schematic control and annunciation wiring diagram for all auxiliary equipment (temperature indicator, alarm circuits, Buchholz relay, PRV, WTI, OTI, OLTC, cooling control etc, Schematic diagram showing the flow of oil in the cooling system, Large scale drawing of high and low tension winding of the transformer showing the nature and arrangement of insulation and terminal connections
7. Drawing/ Wiring diagram showing construction and mounting details of marshalling boxes.
8. Operation and maintenance guide for transformer and OLTC.
9. Detailed loading drawing to enable the Purchaser to design and construct foundations for the transformer.
10. Installation, Operation and maintenance manual along with troubleshooting procedure.

No work shall be performed in connection with the fabrication and manufacture of the Testing Equipment until the technical data and drawings have been approved. The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser.

The cost of supplying drawings and specifications shall be borne by the supplier.
At the time of delivery of Equipment, the supplier shall supply three (3) sets of all approved technical data and drawings in bound book form along with manufacturer's original catalogue of the Equipment.

7.4.1.32 Tests at Manufacturers Works:

7.4.32.1 General

Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests.

7.4.1.32.2 Material Tests:

The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

7.4.1.32.3 Type Test:

Type tests are required on all items to prove the general design of the goods offered. The Bidders shall submit the type test report of offered item from STL member testing laboratories.

7.4.1.32.4 ROUTINE TESTS:

All items shall be subjected to routine tests in accordance with the relevant latest version of IEC, BS & BDS standards at the manufacturers works and shall include, but not be limited to, an operational test.

7.4.1.33 TECHNICAL ORIENTATION AND QUALITY TEST WITNESS :

The following test shall be carried out as per latest version of IEC or equivalent standard unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available:-

Acceptance Tests:-

1. Measurement of turn ratio test;
2. Vector group test;
3. Measurement of winding resistance;
4. Measurement of insulation resistance;
5. Measurement of no load loss & no-load current;
6. Measurement of impedance voltage & load loss;
7. Dielectric withstands Tests;
8. Transformer oil test;
9. Temperature rise test.
10. Separate source voltage withstand test.
12. Tap-changer operation test
14. Dimension and physical check.
15. Magnetic balance test.
16. 33kV & 11kV Bushing CT test (measurement of insulation resistance, polarity, ratio, burden, knee voltage & current, CT secondary winding resistance etc.
17. OTI, WTI, Buchholz, PRD etc. measurement meters and devices calibration & operational functionality check.

The purchaser can carry-out the testing of any no. of transformers during Quality Test Witness. But, the testing of transformers during Quality Test Witness will not be less than 10% at random basis of the transformer ready for inspection but in any case it will not be less than 3 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These test shall be performed as per relevant IEC/BS Standard or equivalent and only routine tests as agreed upon, will be performed.

As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect.

Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the item or complete batch if necessary. In that case Supplier have to replace the Equipment and to make good of them without any financial involvement to the Purchaser. In case any of the Equipment found not conforming with the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

No goods shall be packed, prepared for shipment/delivery unless it has been approved and written instruction has been received by the Purchaser.

7.4.1.34 POST LANDING INSPECTION:

Post landing inspection shall be done immediately after arrival of the goods/materials at the designated store of BPDB; the Engineer & representative from consignee shall conduct Post Landing Inspection in presence of the representative of Supplier. The program of such inspection shall be intimated to the representative of Supplier by BPDB upon arrival of the materials at BPDB store of the Inspector(s) to be selected for test witnessing. Any defect or damage have been found at post-delivery inspection, the defective or damaged panels/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

7.4.2 Technical Specification of 33/11 KV, 16/20 MVA Power Transformer

7.4.2.1 GENERAL

This section of the document includes the design, engineering, manufacture, supply, delivery, offloading, testing & inspection and performance requirements of 33/11KV, 16/20 MVA Power transformers and accessories as specified.

7.4.2.2 CLIMATE DATA

The distribution transformers to be supplied against this tender shall be suitable for satisfactory use under the following climatic condition:

Climate	:	Tropical, intense sunshine, heavy rain, humid.
Maximum Temperature	:	40^0 C
Minimum Temperature	:	03^0 C
Maximum yearly weighted average temperature	:	30^0 C
Relative Humidity	:	50-100%

Annual mean Relative Humidity	:	75%
Average annual rain fall	:	3454 mm
Maximum wind velocity	:	200 km/ hour
Maximum altitude above the sea level	:	Sea level to 300 metres
Atmospherically, Mechanical and Chemical impurities	:	Moderately polluted

The information is given solely as a guide for Tenders and no responsibility for its, accuracy will be accepted nor will any claim based on the above be entertained.

Transformer supplied under this contract will be installed in tropical locations that can be considered hostile to its proper operation. Particular problems that shall receive special consideration relate to operation in a hot environment and presence of the insects and vermin.

7.4.2.3 SYSTEM PARTICULARS

SL. NO.	SYSTEM CHARACTERISTICS	VOLTAGE LEVEL			
1.	Normal System Voltage, kV (Voltage Class)	230	132	33	11
3.	Maximum System Voltage, kV	245	145	36	12
4.	System Frequency, Hz	50	50	50	50
5.	Phase Rotation (Anti-Clock wise)	RST	RST	RST	RST
6.	Type of System Grounding	Solid	Solid	Solid	Solid
7.	Rated Fault Level (3-Phase Symmetrical), MVA 3 sec.	16000	6000	1800	500
8.	Basic Insulation Level, kV	750	650	170	75

High Voltage current carrying equipment should be capable of carrying the three phase fault level for a period of 3 Sec

7.4.2.4 STANDARDS

The equipment specified in this Section of the contract shall conform to the latest edition of the appropriate IEC specifications and other recognized international standard. In particular:

IEC	60076-1	Power transformers (General).
IEC	60076-2	Power transformers (Temperature Rise).
IEC	60076-3	Power transformers (Insulation Levels, Dielectric Tests and External Clearance in air).
IEC	60076-5	Power transformers (Ability to Withstand short circuit)
IEC	60137	Bushings for alternating voltages above 1 kV.
IEC	60156	Method of determination of electrical strength of insulating oils .
IEC	60296	Specification for unused mineral insulating oils for transformers and switchgear.
IEC	60551	Measurement of transformer and reactor sound levels.
IEC	60616	Terminal and tapping markings for power transformers.
IEC	722	Guide to lightning and switching impulse testing of power transformers.
IEC	5493	Protective coating of iron and steel structures against corrosion.

IEC	551	Noise and Vibration of power transformer.

7.4.2.5 Technical Specification:

1.	Rated MVA (ONAN/ONAF)	16/20MVA
2.	Number of Phases	3 (Three)
3.	Frequency	50 Hz
4.	Winding Insulation	Uniform
5.	Normal Transformation Ratio at No-load	33/11.55 KV
6.	Rated HT Voltage (Phase to Phase)	33 KV
7.	Maximum HT Voltage (Phase to Phase)	36 KV
8.	Rated LT Voltage (Phase to Phase)	11 KV
9.	Maximum LT Voltage (Phase to Phase)	12 KV
10.	Rated Current HT (ONAN/ONAF)	280/ 350 Amps
11.	Rated Current LT (ONAN/ONAF)	840/1050 Amps
12.	Basic Insulation Level : a) High voltage winding b) Low voltage winding	 170 KVp 75 KVp
13.	Installation	Outdoor, Tropical, High rainfall & Humidity.
14.	Type	Core, Conservator & Oil Immersed
15.	Type of Windings	Double Wound of Electrolytic Copper, free from burs and splinter.
16.	Type of Cooling	ONAN/ ONAF
17.	Coolant	Type- A, Unused insulating mineral oil, free from PCB (polychlorinated biphenyl)
18.	Type of System Earthing	Effectively Earthed
19.	Bushing Material	Porcelain
20.	Type of Base	On Wheels On wheels with adequate size and 10M length of rails and fixing arrangement.
21.	Direction of Normal Power Flow	HT-LT
22.	Phase connection :(Δ -Y) a) 33 KV winding with bushing CT b) 11 KV winding with bushing CT	 Delta Star
23.	Vector Group	Dyn11
24.	Neutral to be brought out : a) HT b) LT	 Nil Yes
25.	Neutral Insulation	Full uniform insulation and 100% loading capacity.
26.	Maximum Temperature rise over 40^0C ambient at full load & tap change is at normal position : a) Winding by Resistance (^{0}C) b) Oil by Thermometer (^{0}C)	 65^0C 55 ^{0}C
27.	Impulse Front Wave Test Voltage (1.2/50	

	Micro Sec. Wave Shape) : a) High voltage side b) Low voltage Side	 170 KVp 75 KVp
28.	Power Frequency withstand Test Voltage for 1 (one) Minute : a) High voltage side b) Low voltage Side	 70 KV 28 KV
29.	Impedance Voltage at 75^0C, at normal ratio and rated frequency, and at ONAN condition.	8.5%
30.	**Type of tap changer control**	
	Features	The tap changer will be on load auto regulation, remote control and manual. The on load tap changer will immersed in the transformer tank. The diverter switch compartment will be provided with its own oil conservator which, will not be connected to the transformer oil tank. The diverter switch can easily be lifted out of its tank for maintenance and inspection without opening the transformer cover. The on load tap changer will operate by means of a motor drive unit. This unit will install on the side of the transformer.
	On Load Tap changer with motor drive unit manufacturer's name & country	MR, Germany/ ABB, Sweden/ HM, China.
	Tapping Range : a) HT b) LT	 17 Tapping ± 10% in steps of 1.25% i.e. 33 KV ± 8 x 1.25% Nil
31.	Bushing CT for differential protection	400/5A on HV, 1200/5A on LV of accuracy class 5P20, burden 30 VA.
32.	Neutral Bushing CT for Standby Earth Fault (SEF) & Restricted Earth Fault (REF) protection	1200/5-5A on LV neutral of accuracy class 5P20, burden 30 VA.
33.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

34.	**Transformer Oil**	
	Application	Insulating mineral oil for Transformer It will be free from PCB (polychlorinated biphenyl)
	Grade of oil	Type-A
	PHYSICAL PROPERTIES	
	Appearance	Liquid and free from suspended matter or sediment
	Density at 20^0 C	0.895 g/cm^3 (maximum)
	Flash point (Closed cup)	140^0 C (minimum)
	Kinematics Viscosity at -15^0 C	800 c St. (Maximum)
	Kinematics Viscosity at 20^0 C	40 c St. (Maximum)
	Pour point	-30^0 C (maximum)
	ELECTRICAL PROPERTIES	
	Dielectric Strength at 50 Hz (with 2.5 mm standard gap and 40 mm standard depth)	New untreated oil, shall go through filtration treatment before the oil are introduce into the apparatus or equipment. The break down voltage of this oil shall be at least 50KV.
	Loss tangent/Dielectric dissipation factor at temp. 90^0 C, stress 500V/mm to 1000 v/mm and frequency 40 Hz to 62 Hz.	0.005 (maximum)
	CHEMICAL PROPERTIES	
	Neutralization value	0.03 mg KOH/g (maximum)
	Neutralization value after oxidation	0.40 mg KOH/g (maximum)
	Total sludge after oxidation	0.10% weight (maximum)
	PCB Content	Free from PCB
	STANDARDS	Performance and testing of oil shall comply with the latest revision of the relevant standards BS 148 : 1972, IEC-60296 or latest revision there on.
35.	**FEATURES & ACCESSORIES OF TRANSFORMER:**	

	a) Bushing Insulator on HT and LT. b) Arcing horns on HT and LT bushings. c) Supply of Remote Tap Changer Control (RTCC) facility as per technical specification & GTP. d) Oil conservator. e) Buchholz relays in main conservator oil pipe. f) Tap Changer Protective Relay in between conservative and tap changer oil pipe. g) Conservator drain valve, breather and oil level gauge with alarm contact. h) Pressure Relief Device (PRD). i) Dial type thermometers with alarm and trip contracts. j) CT for winding temperature shall be located at mid-phase (Y-phase) of the transformer. k) Radiators with valves. l) Bladder/Airbag in conservator to separate air from oil. m) One inspection hole with cover. n) Facilities for lifting cover and coil assembly from tank. o) Lifting lugs for lifting complete Transformer. p) Base designed for rollers with bi-directional flanged rollers parallel to either Centre line. q) Tank oil sampling, draining valve and oil centrifuging outlets.
	r) Tank earthing points. s) Fans for forced cooling (ONAF). t) All mounting accessories including rails (2 Nos. rails each 10 Meter long). u) All equipment should be fully tropicalized. v) Painting to approved colour and shade. w) Rating nameplate and diagram plate of stainless steel having engraved letters filled with black enamel paint. x) The oil shall be supplied/ delivered in non-returnable sealed containers/ drums. y) The oil shall be fresh, unused, cleaned and free from suspended matter or sediment. z) The test shall be carried out on the oil as to be supplied without drying and degassing. aa) Inhibited oils must not contain anti-oxidant additives. bb) Laminated, detailed Schematic Diagram of Control Circuit of Transformer & Tap changer inside Marshalling kiosk. cc) Dehydrating Silica-gel breather. dd) Air release plug. ee) Earthing terminals with lugs. ff) Thermometer pockets. gg) Winding temperature indicator with two contacts hh) Bottom mounting channel for 16/20 MVA ii) Operation and maintenance manual along with troubleshooting procedure and installation guideline/manual shall be supplied with each transformer.

36	Transformers shall be provided with cable boxes for both HV and LV terminals to enable cable connection directly. Cable boxes shall be completed with all necessary fittings in which primary and the secondary bushings shall preferably be of horizontal orientation to ease the cable termination. Cable boxes shall be adequate proportions and designed in accordance with BS6435 or relevant other international standard in such a manner that they can be opened for inspection without disturbing the gland plate or incoming cables(s). Provision for connection of two cables per phase shall be provided. Cable boxes shall be designed for ease of access for jointing and connecting the cable. They shall be constructed to minimize the danger of fragmentation; cast iron boxes shall not be used. Disconnecting links shall be provided in the boxes to facilitate testing of the transformer and cables independently. The Cable boxes shall be of such a design as to prevent ingress of moisture. The Contractor shall guarantee (test certificates shall be supplied as proof) that the air clearances and the creep age path on the bushing connecting to the transformers shall be such that the completed installation shall withstand in air the impulse and power frequency test voltages.
37	**Following instructions to be followed for Submission of Test reports & Calculation:**
	aa) All Type test Report and related routine test report shall be of same transformer of same name plate serial no. bb) Calculation of load loss shall be provided for load loss in all 3(three) tap position (Nominal, Maximum, Minimum).

7.4.2.6 (A) INFORMATION REQUIRED

The Tenderer/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information/Documents have to be submitted along with the tender:-

a) The Tenderer/Manufacturer shall submit with the bid the testing procedure & list of testing/ measuring equipment, meters etc. used for Factory test witness.

b) Construction, Installation, Operation & Maintenance Manual.

7.4.2.7 CAPITALIZED COST:

Bidder shall declare guaranteed No Load Loss and Full Load Loss value in GTP. Any Tenderer quoted the No Load Loss & Full Load Loss above the upper limit of the loss as mentioned in GTP in Tender Document will not be considered for further evaluation & treated as non- responsive. The Tenderer who will quote the No Load Loss & Full Load Loss below the lower limit of No Load Loss & Full Load Loss as mentioned in GTP. In that case during evaluation Capitalization cost will be calculated only on the basis of the lower limit of No Load Loss & Full Load Loss.

Tenderers quoted No load Loss and Full load loss shall be supported by loss calculation, otherwise the bid will also be treated as non- responsive.

The fixed and running losses are to be low as consistent with reliable and economical use of materials. The cost of losses is to be minimized and the following capitalized parameters will be used in the evaluation of the transformer:

$C = 68{,}706 \times e \times P_0 + 54{,}964 \times e \times P_{FL}$

Where,

C	=	Capitalized cost of transformer loss in Bangladesh Taka.
e	=	Energy Cost, Tk. 6.00/KWh
P_{FL}	=	Full Load losses at rated voltage, normal ratio and rated frequency in ONAF condition at 75^0C in KW + Auxiliary loss in KW
P_0	=	No load losses at rated voltage, normal ratio and rated frequency in KW

The cost of energy (C) will be added to the quoted prices to arrive at the evaluated cost of the transformer.

The contract will be cancelled if losses exceed the guaranteed value by an amount in excess of followings:

Total losses : 10%
Component : 15% of each component loss (Unless the total losses exceeds 10%).

7.4.2.8 SHIPPING:

All the delicate components shall be dismantled and packed in strong wooden boxes having inside lined with metallic sheets with proper sealing to protect the content from accidental direct exposure to weather during storage. The holes of the transformer tank shall be sealed with proper metal plate and gaskets to prevent leakage of oil and its contamination with atmospheric moisture. The transformer shall be shipped with radiators, busing conservator etc. dismantled but the tank filled with oil. The transformer oil from radiators and conservator shall be shipped in non-returnable drums. The bushing shall be shipped in oil sealed containers to avoid moisture absorption during shipment and storage. Oil shall be complying with IEC-60296.

7.4.2.9 BUSHING:

The bushings shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size & shall be suitable for bimetallic connection. The insulation class of the high voltage neutral bushing shall be properly coordinated with the insulation class,

of the high voltage winding. Each bushing shall be so coordinated with the transformer insulation so that all flash over will occur outside the tank. All main winding and neutral leads shall be brought out through "out door" type bushings which shall be so located that the full flashover strength will be utilized and the adequate phase clearance shall realized. All porcelain used in bushings shall be of the wet process, homogeneous and free from cavities or other flaws. The glazing shall be uniform in colour and free from blisters, burrs and other defects.

7.4.2.10 HT BUSHING:

Provide 3 porcelain outdoor type, oil filled, impulse tested bushing with arcing horns of standard gap and bolted type terminal connectors, with head shrink rubber insulated cap suitable for connection to the incomes leads of ACSR Gross Beak (636 MCM) conductor.

7.4.2.11 LT BUSHING:

Provide 4 porcelain outdoor type bushing with bolted type connectors, suitable for connection to outgoing leads of one numbers of 500 Sq.mm XLPE, single core copper conductors per phase and suitable for head shrink termination.

7.4.2.12 FAULT CONDITIONS:

The transformer shall be capable of withstanding, on any tapping, for three seconds without damage an external short circuit between phases. The transformer winding shall be capable of withstanding for three seconds without damage a short circuit between one phase and earth with the neutral of the transformer directly earthed. For the purposes of this clause a fault level of 1800 MVA at the transformer 33KV terminals shall be assumed.

Evidence shall be submitted with the Tender as to the extent to which the manufacturer has provided or is able to prove either by calculation or test the ability of the specified transformers to withstand on any tapping, without damage under service conditions, the terminal and dynamic effects of external short circuit.

The Bid shall state tin the Technical Schedule a brief description of those transformers or parts thereof, which have been subjected to short circuit tests or for which short circuit calculations are available. It is preferred that this information relates to designs comparable with the transformers bidder but in the event this is not so the Engineer reserves the right to require calculating to prove that the design of transformers tendered will satisfactorily comply with this clause : such calculations being in accordance with the latest revision of IEC/ BS standard.

7.4.2.13 NOISE:

Vibration and noise levels of all transformers and auxiliary plant shall be in accordance with the IEC 551 and its latest version. The contract price shall include noise level tests to be carried out on one transformer.

7.4.2.14 HARMONIC SUPPRESSION:

Transformer shall be designed with particular attention to the suppression of harmonic voltages especially the third and fifth harmonics and to minimize the detrimental effects resulting there from.

7.4.2.15 IMPEDANCE AND REGULATION:

The Bidder shall be state in the Technical Schedules guaranteed values of impedance measured on normal and extreme tapping and the voltage regulation from no load to CMR at unity power factor and at 0.9 lagging power factor with constant voltage across the higher voltage windings.

7.4.2.16 MAGNETIC CIRCUIT:

The design of the magnetic circuit shall be such as to avoid static discharge development of short circuit paths internally or to the earthed clamping structure and the production of flux components normal to the plane of the laminations. Each lamination shall be insulated with a material stable under the action of pressure and hot oil.

The winding structure and major insulation shall be designed to permit an unobstructed flow of cooling oil through core cooling oil ducts to ensure efficient core cooling.

The magnetic circuit shall be insulated from all structural parts and shall be capable of withstanding a test voltage to core bolts and to the frame of 2000 volts rms for one minute.

7.4.2.17 FLUX DENSITY:

Cores shall constructed from clod rolled grain oriented steel sheets. Provided the contractor can provide adequate evidence that there will be no adverse effects due to stray flux heating of core with the quality of steel employed, designs may be offered such that when operating under the most onerous conditions, flux density in any part of the magnetic circuit does not exceed 1.7 Tesla.

The Contractor shall determine the operating conditions under which the maximum flux density will be attained within the following simultaneously applied limits.

- Frequency	**:**	50 Hz
- LV and HV Voltage	**:**	Up to but not exceeding the specified maximum System voltage.
- Load	**:**	The transformer may be subjected to intermittent overloading of 150% rated MVA at 0.8 power factor lagging in accordance with IEC-60035.

The maximum flux densities anticipated under these conditions are to be stated in Technical Schedules (GTP).

7.4.2.18 **WINDINGS:**

g) The windings shall be of high-conductivity electrolytic copper.

h) The transformer windings shall have uniform insulation as defined in the latest revision of IEC standard. The insulation of the coils shall be such as to develop the full electrical strength of the windings. All materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil, and shall not soften or otherwise be adversely affected under the operating conditions.

i) The transformers shall be designed to withstand the impulse voltage levels and the power frequency voltage tests specified in the Technical Schedules.

j) The winding shall be located in a manner which will ensure and that they remain Electro-statically balanced and that their magnetic centers remain coincident under all conditions of operation.

k) The winding shall also be thoroughly seasoned during manufacture by the application of axial pressure at a high temperature for such length of time as will ensure that further shrinkage is unlikely to occur in service.

l) All electrical connections within windings shall be brazed to withstand the shocks, which may occur through rough handling and vibration during transport switching and other transient service conditions.

m) Coil clamping rings shall be of the on on-magnetic steel or insulating materials built up from flat laminations. Auxiliary laminated material other then Bakelite paper is not to be used. Where Bakelite paper rings are used with the layers of paper lying in the axial direction, the rings may be relied upon to provide the major insulation between the windings and frame subject to there being adequate creepage distance. Any metal pieces in contact with laminated rings shall be designed and secured so that they do not weaken the electrical or the mechanical properties of the rings. If the winding is built up of section or of disc-coils separated by spacers, the clamping arrangement shall be ensure that equal pressure are applied to all columns of spacers.

h) The winding shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs can be readily done, without special equipment. The coils shall be supported between adjacent sections by insulating spacers and the barriers, bracings and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot sports in the windings. The insulation paper shall be of high quality and the value of degree of polymerization shall not be less than 1200 dp and the necessary test certificate shall be submitted along with the Pre-delivery inspection report. Provision shall be made in the tank, for taking sample, in future, of paper for testing purpose and location shall be easily accessible and indicated on the transformer tank by affixing special caution plate.

7.4.2.19 INTERNAL EARTHING ARRANGEMENT:

All metal parts of the transformer with the exception of the individual core lamination, core bolts and associated individual clamping plates, shall be maintained at some fixed potential.

The top main core clamping structure shall be connected to the tank body by a copper strap and the bottom main core clamping structure shall be earthen by one or more of the following methods:

- by connection through vertical tie rods to the top structure.
- by direct metal-to-metal contact with the tank base maintained by the weight of the core and windings.
- by connection to the top structure on the same side of the core as the main earth connection to the tank.

The magnetic circuit shall be earthed to the clamping structure at one point through a removable link placed in an accessible position just beneath an inspection opening in the tank cover and which, by disconnection, will enable the insulation between the core and clamping plates, etc. to be tested at voltages up to 2 KV for the purpose of checking deterioration during service. The connection to the link shall be on the same side of the core as the main earth connection. These requirements are mandatory.

Magnetic circuits having an insulated sectional construction shall be provided with a separate link for each individual section and the arrangement of the connections shall be subject to the approval of the Engineer.

Where oil ducts or insulated barriers parallel to the plane the laminations divide the magnetic circuits into two or more electrically separates parts, the ducts and insolating barriers which have the thickness greater than 0.25, mm are to be bridged with tinned copper strips so inserted as to maintain electrical continuity.

Where coil-clamping rings are of metal at each potential, each rings shall be connected to the adjacent core clamping structure on the same side of the transformer as the main earthing connection.

Main earthing connections shall be a cross-sectional area of not less than 100mm2 but connections inserted between laminations may have cross sectional areas reduced 20mm2 when in close thermal contact with the core.

7.4.2.20 CORE

The core shall be constructed from high grade cold rolled non-ageing grain oriented silicon steel laminations, M4 or Superior Grade. Only prime quality CRGO sheets should be used in the transformers and no Second/Defective/Scrap CRGO finds way into transformers. Therefore

regarding quality control following documents are to be furnished with the Post – delivery inspection report.

1. Invoices of supplier
2. Mill's test certificate
3. Packing list.
4. Bill of lading
5. Bill of entry certificate by custom
6. Description of material, electrical analysis, Physical inspection, certificate for surface defects, thickness and width of the material.

It is to note that, using seconds/defective CRGO sheets or load losses found to be more than stipulated limit, heavy penalty will be imposed or the suppliers will be black listed.

7.4.2.21 TRANSFORMER TANK

The Transformer Tank shall be welded construction fabricated from high tensile steel plate and shall be designed to withstand full vacuum. The transformer shall have air seal type oil conservator tank at the top.

k) The transformer tank and cover shall be fabricated from good commercial grade low carbon steel suitable for welding and of adequate thickness.
l) The transformers tank shall be capable of withstanding full vacuum without deflection.
m) The plates (tank & Cover) shall have the following minimum thickness.

Length of Transformer Tank	Minimum Thickness	
	Side Plates	Bottom Plates
Less than 2500 mm	Min 6 mm	Min 9 mm
Greater than 2500 mm	Min 9 mm	Min 12 mm

n) The base of each track shall be so designed that it is possible to move the complete transformer unit in any direction without injury when using rollers, plates or rails. A design, which required that slide rails be placed in a particular position, is not to be used. 16/20 MVA and lower rate transformers shall be provided with base plates having bi-directional wheels for placing on rails.

o) An inspection window with a welded flange & a bolted cover shall be provided on the tank cover. The manhole shall be of a sufficient size to ease access to the lower ends of the bushings, terminals etc.

p) Lifting eyes or lugs shall be provided on all parts of the transformers requiring independent handling during assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs and bosses properly secured to the sides of the tank for lifting the transformers either by crane or by jacks. The design of the tank, the lifting lugs and bosses

shall be such that the complete transformer assembly filled with oil can be lifted with the use of those lugs without any damage or distortions.

q) The tank shall be provided with two suitable copper alloy or any other suitable material lugs for the purpose of grounding.

r) The tank shall be so designed that with the cores and windings in position there shall be no possibility of air or gas being trapped when filling the tank with oil. Likewise, water shall not be trapped on the exterior of the tank.

s) The tank shall be fitted with pockets for a thermometer and the bulb of a winding temperature indicator and an oil temperature indicator.

t) Necessary drain valves, filter valves, vales to take oil sample etc shall be provided.

7.4.2.22 Conservator Tank

A conservator tank shall be mounted above the highest point of the oil circulating system of the equipment. Tanks shall be formed of substantial steel plate. Connections between the main tank and the conservator shall be such that air or gas is not entrapped and the Buchholz relays can be correctly installed. One end of the conservator shall be fixed by bolts so that it can be removed to enable the tank to be cleaned. The capacity of each conservator tank shall be adequate to accommodate the expansion and contraction of oil in the whole system, over the extreme range possible in operation, i.e. equipment unenergised in an ambient temperature of 5 deg. C to the condition corresponding to maximum oil temperature rise. Conservator shall be fitted with:-

(a) A hydro compensator for separating oil and air. A dehydrating breather shall be used for the air intake of the hydro compensator. Alarm for leak of the hydro compensator shall also be provided.

(b) At least one magnetic oil level indicator type visible from ground level and indicating the oil levels over the range specified above. The oil level indicator shall be marked to indicate the correct oil level with the oil at a temperature of 5 deg. C, 30 Deg. C and 90 deg. C. The temperature markings shall preferably be integral with the level indicating device but subject to the approval of the Authority.

(c) Low oil alarm initiating device.

7.4.2.23 Pressure Relief Device

The transformer shall be fitted with a pressure relief device designed to protect the tank from damage and to control the expulsion of oil during an internal fault. The pressure relief device shall be of the spring-loaded diaphragm type capable of opening fully within two milliseconds of detecting an excess pressure, and shall fully reseal after release of the exceeded pressure. Corrosion resistant materials shall be used and a visual indication of operation shall be provided.

Two pairs of normally open contacts and a suitable terminal box shall be provided for remote electrical indication and tripping.

7.4.2.24 GASKETS

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight.

7.4.2.25 OIL

All transformers shall be filled to the required level with new, unused, clean, standard mineral oil after treatment in compliance with IEC 60296 & BS 148.

7.4.2.26 ACCESSORIES

7.4.2.26.1 Winding Temperature Indicator

The transformer shall be provided with a winding temperature indicator and combined alarm and trip relays of approved design. The alarm and trip settings shall be adjustable. The winding Temperature Indicator shall also be provided with additional contacts for automatic 'start/stop' of cooling plant (fans). It shall be fitted with dial indicator calibrated in degrees Celsius and fitted with a hand reset pointer the highest temperature attained. The winding temperature indicator shall be so mounted in the transformer marshalling kiosk so that the dial is not more than 1500 mm from ground level. The cover shall be equipped with a viewing aperture of adequate size, fitted with clear, reinforced glass.

7.4.2.26.2 Oil Temperature Indicators

The transformer shall be provided with an oil temperature indicator of approved design incorporating contacts and relay(s) for initiating alarms and trips. The indicator shall be fitted with a dial calibrated in degrees Celsius, with a hand reset pointer to register the highest temperature attained.

The oil temperature indicator shall be mounted in the transformer marshalling kiosk so that the dial is not more than 1500 mm from the ground level and the cover shall be equipped with viewing aperture of adequate size, fitted with clear, reinforced glass.

7.4.2.26.3 Buchholz relay

A Buchholz relay with alarm and tripping contacts to detect accumulation of gas and sudden changes of oil pressures, complete with two shut-off valves and flange coupling to permit easy removal without lowering oil level in the main tank, a bleed valve for gas venting and test valve

shall be provided. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation & taking gas sample.

7.4.2.26.4 Breathers

Each transformer and tap changer conservator shall be provided with a silica gel breather complete with oil seal, oil level indication window and a sight glass for inspection of the silica gel. Due to the climatic conditions at site, this breather shall be liberally sized and one size larger than would be fitted for use in a temperate climate.

A visual indication of the extent to which the drying agent has absorbed moisture is preferred, showing how much active material remains effective.

Maintenance free breather shall have sensor controlled heating apparatus. The supply voltage shall be 230V AC. Adequate cable shall be provided to connect with marshalling box.

7.4.2.26.5 Padlocks

The supplier shall provide pad lockable handles and non-ferrous padlocks with duplicate keys for tap changer control panel and kiosks door to prevent all unauthorized access and operation.

7.4.2.26.6 The other accessories shall be provided is listed below

a) Ladder permanently fixed with transformer tank
b) Dial Thermometer with pocket for oil temperature indicator with one set of alarm and one set of trip contacts and maximum reading pointer.

7.4.2.27 Marshalling Kiosk (box):

Marshalling box shall be connected at one side of transformer. It shall consist of WTI (winding temperature indicator) and OTI (oil temperature indicator), magnetic oil gauge and Buchholz relay and other control terminals. WTI are in two numbers, one for HV and other for LV. It shall also consist of all auxiliary contactors as required in the order to make necessary potential free contacts for remote alarm and tripping, a heater which is used to absorb the moisture in the box, SPN socket outlet, complete with switch and HRC fuse for hand lamp connection.

7.4.2.28 Painting

The minimum standards acceptable are:

e) cleaning by shot blasting to Grade Sa 2.5 of ISO 8501-1

f) All sheet steelwork shall be degreased, pickled and phosphated in accordance with IEC 60076.

g) Interior surface of mechanism chambers, boxes and kiosks, after preparation, cleaning and priming shall be painted with one coat of zinc chromate primer, one coat of phenolic based

undercoating, followed by one coat of phenolic based finishing paint to white color followed by a final coat of anti-condensation white paint of a type and make to the approval of purchaser. A minimum overall paint film thickness of 150 micons shall be maintained throughout.

h) Exterior steel work and metalwork, after preparation and priming shall be painted with one coat odxinc chromate primer, one coat of phenolic based under coating and two coat of micaceous iron oxide paint, then painted with final coat of phenolic based hard gloss finishing paint of the light grey shade to provide an overall minimum paint thickness of 200 microns.

7.4.2.29 Galvanizing

All galvanizing shall be carried out by the hot dip process, in accordance with specification ISO 1460. However, high tensile steel nuts, bolts and spring washers shall be electro galvanized. The zinc coating shall be smooth, continuous and uniform. It shall be free from acid spots and shall not scale, blister or be removable by handling or packing. There shall be o impurities in the zinc or additivies to the galvanic bath which could have a detrimental effect on the durability of the zinc coating.

Before pickling, all welding, drilling, cutting, grinding etc must be complete and all grease, paint, varnish, oil, welding slag etc completely removed.

The weight of zinc deposited shall be in accordance with the BS 729, ISO 1460 and shall be not less than 0.61Kg/sq. mtr. with minimum thickness of 86microns for items of thickness more than 5mm, 0.46Kg/sq.mtr. (64microns) for items thickness between 2mm and 5 mm and minimum 0.33kg/sqmm (47microns) for the item less than 2mm thick. Repair of galvanizing on site will generally not permitted.

7.4.2.30 Terminal marking

Each terminal including the neutral shall be clearly marked on both the primary and secondary side in accordance with the diagram of connection supplied with the transformers.

The terminal marking shall be clear and permanent. Painted markings are not acceptable. the winding shall be leveled as follows:

High voltage	:	3 phases	A B C
Low voltage	:	3 phases and neutral	a b c n

7.4.2.31 EVALUATION CRITERIA

a) The Tenders will be evaluated on the basis of the capitalized cost of the Transformer losses.

b) Bidder will declared/ guaranteed No-Load loss and Full load loss value, otherwise the bid will be **rejected.**

c) Bidders declared/ guaranteed percentage impedance value shall be within the specified value, otherwise the bid will be **rejected.**

7.4.2.32 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST:

Transformer will be tested during technical orientation & quality acceptance and will be accepted if the measured transformer losses are within the offered value or within the following tolerance with deduction of amount from the contract price as below:

i) Any component loss (No load loss or Full load loss) may exceed up to 15% of the offered component loss, provided that the total loss (No load loss + Full load loss) shall not exceed 10% of the offered total loss. If any component loss exceeds 15% of the offered component loss, the full consignment will be rejected.

ii) Total loss (No load loss + Full load loss) may exceed up to 10% of the offered total loss. If it exceeds 10%, the full consignment will be rejected.

iii) Percentage Impedance may vary up to ±10% of the specified value. If the value exceeds the tolerance (±10%), the full consignment will be rejected.

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the offered value or within the acceptable limit as specified in (i), (ii) and (iii) provided an amount will be deducted from the Contract price for the loss(s) exceeding the offered/declared loss(s) according to the following formula:-

Amount to be deducted from the Contract price

= Contract Price x {(Measured loss - Specified loss /declared loss) ÷ Specified loss/declared loss} X %MT

Where,

	Measured Loss (in KW)	=	Measured Average No load Loss* 1+ Measured Average Full Load Loss* 2.
	Offered Loss (in KW)	=	Offered No Load Loss + Offered Full load loss
	Transformer Economic Life	=	20 Years

%MT (Percentage of Monetized Transformer) = % of the Monetized Transformer found during factory test witness by BPDB's inspection team whose measured loss(s) (No load loss or Full load loss or Both) exceed the offered loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 80 and the no. of selected transformers during QAT/pre-delivery inspection is 8, 6 nos. are found within the offered losses and 2 nos. are found exceeding the offered losses then the %MT will be (2/8)x100=25%

* 1Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the offered No-load loss ÷ Nos. of tested transformer(s) which exceeds the offered No-load loss]

* 2Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the offered Full-load loss ÷ Nos. of tested transformer(s) which exceeds the offered Full-load loss.

7.4.2.33 Mandatory SPARE PARTS

- As per Price Schedule.

7.4.2.34 Approval of Drawings

The supplier shall submit the following drawings in AutoCAD format and in hard copy along with the documents as per following list for the approval of the purchaser within commencement period.

11. Full Technical Specification and Guaranteed Technical Particulars
12. Max. Temp. Rise of Winding & Oil over 40^0C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.
13. Calculation of Total full Load loss (I^2R loss, winding eddy current loss & Stray loss etc.) at ONAN & ONAF condition for nominal Tap, Tap 1 & 17.
14. Calculation of No-load loss and current.
15. Calculation of flux density, Core diameter, Gross cross-sectional area of Core, Net cross-sectional area of Core, Core weight, Stack thickness and Mean length of core along with the drawing of window height, Core leg center etc.
16. Calculation of LV, HV & Tap winding dimension, Cross sectional area of LV, HV, Tap winding, Copper Weight (LV, HV & Tap winding) and Oil volume.
17. Calculation of Cooling at ONAN & ONAF condition for Total Losses at Tap 17.
18. Calculation of percentage impedance at ONAN & ONAF condition for nominal Tap, Tap 1 & 17.
19. Calculation of temperature rise for Top Oil, mean Oil, LV & HV winding at ONAN & ONAF condition for nominal Tap, Tap 1 & 17.
20. General outline drawing showing front, side elevation and plan of the transformer and accessories with detailed dimensions. The clearances between HV and LV terminals and ground should also to be shown.
21. Drawings of each type of bushings, lifting dimensions, clearance between HT and LT terminals and ground, quantity of insulating oil, name plate details etc.
22. Large scale drawings of high and low-tension windings of the transformers showing the nature and arrangement of insulators and terminal connections.
23. Schematic control and annunciation wiring diagram for all auxiliary equipment (temperature indicator, alarm circuits, Buchholz relay, oil surge relay, PRV, MOG, WTI, OTI, AVR relay, OLTC, cooling control etc, Schematic diagram showing the flow of oil in the cooling system, Large scale drawing of high and low tension winding of the transformer showing the nature and arrangement of insulation and terminal connections.
24. Drawing/ Wiring diagram showing construction and mounting details of marshalling boxes.
25. Operation and maintenance guide for transformer and OLTC.

26. Detailed loading drawing to enable the Purchaser to design and construct foundations for the transformer.
27. Installation, Operation and maintenance manual along with troubleshooting procedure.
28. Catalogue and Manual of Core, Cu winding, Buchholz relay, oil surge relay, PRV, MOG, WTI, OTI, AVR, OLTC, Bushing CT, Radiator, Cooling Fan etc.

No work shall be performed in connection with the fabrication and manufacture of the Testing Equipment until the technical data and drawings have been approved. The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser.

The cost of supplying drawings and specifications shall be borne by the supplier.

At the time of delivery of Equipment, the supplier shall supply three (3) sets of all approved technical data and drawings in bound book form along with manufacturer's original catalogue of the Equipment the office of Director, Design & Inspection-II, BPDB, 9/B, Motijheel C/A, Dhaka, Bangladesh, Telephone # 88-02-9550404.

7.4.2.35 TESTS AT MANUFACTURERS WORKS:

7.4.2.35.1 GENERAL

Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests.

7.4.2.35.2 MATERIAL TESTS:

The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

7.4.2.35.3 TYPE TEST:

Type tests are required on all items to prove the general design of the goods offered. The Bidders shall submit the type test report of offered item from internationally reputed independent testing laboratory.

7.4.2.35.4. ROUTINE TESTS:

All items shall be subjected to routine tests in accordance with the relevant latest version of IEC, BS & BDS standards at the manufacturers works and shall include, but not be limited to, an operational test.

7.4.2.36 TECHNICAL ORIENTATION AND QUALITY TEST WITNESS :

The following test shall be carried out as per latest version of IEC or equivalent standard unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available:-

Acceptance Tests:-

1. Measurement of turn ratio test;
2. Vector group test;
3. Measurement of winding resistance;
4. Measurement of insulation resistance;
5. Measurement of no load loss & no-load current;
6. Measurement of impedance voltage & load loss;
7. Dielectric withstands Tests;
8. Transformer oil test;
9. Temperature rise test.
10. Separate source voltage withstand test.
11. Tap-changer operation test
12. Dimension and physical check.
13. Magnetic Balance Test
14. Leak Testing with pressure
15. 33kV & 11kV Bushing CT test (measurement of insulation resistance, polarity, ratio, burden, knee voltage & current, CT secondary winding resistance etc.
16. OTI, WTI, Buchholz, PRD etc. measurement meters and devices calibration & operational functionality check.

The purchaser can carry-out the testing of any no. of transformers during Quality Test Witness. But, the testing of transformers during Quality Test Witness will not be less than 10% at random basis of the transformer ready for inspection but in any case it will not be less than 3 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.

Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These test shall be performed as per relevant IEC/BS Standard or equivalent and only routine tests as agreed upon, will be performed.

As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect.

Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the item or complete batch if necessary. In that case Supplier have to replace the Equipment and to make good of them without any financial involvement to the

Purchaser. In case any of the Equipment found not conforming with the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

No goods shall be packed, prepared for shipment/delivery unless it has been approved and written instruction have been received by the Purchaser.

7.4.2.37 POST LANDING INSPECTION:

Post landing inspection shall be done immediately after arrival of the goods/materials at the designated store of BPDB; the Engineer & representative from consignee shall conduct Post Landing Inspection in presence of the representative of Supplier. The program of such inspection shall be intimated to the representative of Supplier by BPDB upon arrival of the materials at BPDB store of the Inspector(s) to be selected for test witnessing. Any defect or damage have been found at post-delivery inspection, the defective or damaged panels/ materials/ goods to be repaired/ replaced by the Bidder/ supplier at his own cost.

7.4.3 TECHNICAL SPECIFICATION OF 33/.415kV, 250kVA STATION TRANSFORMER

7.4.3.1 GENERAL SPECIFICATION:

1.	Installation	Outdoor, Tropical, High Rainfall & Humidity
2.	Type	Dry, Core type, step down
3.	Coolant	Air natural
4.	Method of Cooling	AN
5.	Phases	3 (Three)
6.	Frequency	50 Hz.
7.	Winding	Two windings of high conductivity copper
8.	KVA Rating	250 KVA
9.	Rated Voltage at no-load	33/0.415 kV
10.	Vector Group	Dyn11
11.	Percentage Impedance at 75^0C, %	6 %
12.	No Load Loss	Max 1200 Watts
13.	Load losses at rated full load at nominal tap at 75^0 C, Watts	Max 4000 Watts
14	LV Maximum Temperature Rise at full load over ambient temperature	100
15	HV Maximum Temperature Rise at full load over ambient temperature	100
16	Insulation Material	Class F
17	Noise Level (Maximum)	55 dB

18	Magnetization current at normal voltage	5.56 A@LV
19	Maximum ambient temperature	50 ^{0}C

7.4.3.2 Major Components

H.T. WINDING :	
Nominal rated voltage	33 kV
Maximum system voltage	36 kV
Basic insulation level (minimum)	170 kV
Tap Changer	+3x2.5%, 0, -3x2.5% of rated kV & all fully rated capacity. Tap Changer shall be off load type, manually operated from an external five-position mechanism.
Inter phase connection	Delta
Bushings	Porcelain, outdoors type with arcing horns of standard gap, mounted on top of tank. Quantity - 3 Nos.
Power frequency withstand voltage for one minute	70 kV
L.T WINDING :	
Nominal rated voltage	415 volts
Highest system voltage	453 volts
Inter phase connection	Y (Wye) with neutral brought out.
Bushings	Porcelain, outdoor type, mounted on the side of tank. (Longest side) Quantity – 4 nos.
Power frequency withstand voltage for one minute	3kV

7.4.3.3 Features and Accessories

a) All bolts and nuts connected with transformer tank, conservator, radiator etc. shall be of non-ferrous metal. If it is ferrous metal, it shall be hot dip galvanized as per standard ASTM A90/ BS EN ISO 1461:1999.
b) Lugs for lifting & towing complete unit.
c) Facilities for lifting core & coil assembly.
d) Base designed for platform mounting on poles.
e) Each H.T. bushing shall have bolted type bimetallic connector suitable for accommodating ACSR conductor having Dia. range from 9mm to 14.5mm.
f) Each L.T. bushing shall have bolted type bimetallic connector for accommodating copper/AAC of area range 2x70mm^2 to 2x120mm^2.
g) The L.T. bushing shall be installed on the side/ top lengthwise of the transformer body. However radiator shall be avoided on this side on the body.
h) Earthing terminals at the bottom corners of Tank.
i) Name plate with transformer rating & winding diagram made of stainless steel shall have engraved letters filled with black enamel.
j) The tank & radiator or flanged radiator shall be painted with two coats of gray finishing paint on suitable prime coats.

k) Transformer capacity with Sl.No. and BPDB Contract No. should be marked with emboss/ engrave on the transformer tank adjacent to name plate easily visible from ground.
l) HT and LT bushing shall be outdoor porcelain type
m) Set of sundries such as similar wiring terminals boards and glands for multi-core 0.415KV Power cables, 33KV terminal connectors suitable for ACSR etc.
n) IEC 60076-11 or other equivalent Standard is to be followed for design, manufacture, testing and performance test.

7.4.3.4 Information Required

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing Specification and Technical Data for crucial components of offered 33/0.415KV, 250KVA, 3-Phase, Dyn11dry type station transformer.
b) Detail dimensional drawings of offered 33/0.415KV, 250KVA, 3-Phase, Dyn11dry type station transformer.
c) Manufacturer's valid ISO 9001 Certificate;

7.4.3.5 ACCEPTANCE CRITERIA OF TRANSFORMER LOSS AND PERCENTAGE IMPEDANCE DURING FACTORY TEST WITNESS

Transformer will be tested during factory test witness and will be accepted if the measured transformer losses are within the specified value or within the following tolerance with deduction of money from the quoted/ contract price as below :

i) Each component loss (No load loss or Full load loss) may exceed up to 15% of the specified component loss, provided that the total losses cannot be exceeded 10% of the specified total losses.
ii) Percentage Impedance may vary up to ± 10 % of the specified value.
iii) The purchaser can carryout the testing of any no. of transformers during pre-delivery inspection. But, the testing of transformers during pre-delivery inspection will not be less than 10% at random basis of the transformer ready for inspection but in any case it will not be less than 2 nos. The manufacturer will provide all arrangements for the testing of transformers desired by the purchaser in his factory.
iv) If the results of any transformer exceeds the specified losses and impedance (each component loss exceeds more than 15% or total loss exceeds more than 10% of the specified losses or percentage impedance exceeds 4±10% then the whole lot will be rejected or on request of the supplier/manufacturer every transformer may be tested (Transformer losses, percentage impedance, vector group test etc.) at his factory premises/CERS, BPDB by the BPDB inspection team. If the said transformers are tested by the BPDB inspection team at the manufacturers/suppliers premises, then the testing fees at the rate of Tk. 2000/-(Two thousand) per transformer shall be paid by the supplier through invoice in advance. If the said transformers are tested at CERS, BPDB all the expenditure for carrying, loading/unloading and testing fees fixed by the CERS are to be borne by the supplier in advance. After completion of the test, the transformer passes the test will be properly sealed by the inspection team. The supplier will be liable to protect those seal up to delivery to the BPDB's designated Store(s).

The transformers which pass the tests will be accepted by BPDB subject to fulfillment of the other qualification criteria as per contract. The remaining transformers failed to qualify the tests will be rejected.

v) If the measured loss(es) (No load loss or Full load loss or Both) of the tested sample transformer(s) during factory test witness by the BPDB's inspection team and test performed by BUET/ DUET/ CUET/ KUET/ RUET exceed the specified loss (No load loss or Full load loss or Both) but remain within acceptable limit as specific in clause 7.11(i) & (ii), then an amount will be deducted from the Contract price for the loss(s) exceeding the specified loss(s) (No load loss or Full load loss or Both) according to the following formula :
Amount to be deducted from the Contract price

= Contract Price x {(Measured Loss - specified Loss) ÷ specified Loss} x %MT

Where, Contract Price = Total Contract Price
Measured Loss = Measured Average No-load Loss* 1 + Measured Average Full Load Loss* 2.
Specified Loss = Specified No Load Loss + Specified Full load loss

%MT (Percentage of Monitized Transformer) = % of the Monitized Transformer found during factory test witness by the BPDB's inspection team and test performed by BUET/ DUET/ CUET/ KUET/ RUET whose measured loss(es) (No load loss or Full load loss or Both) exceed the specified loss (No load loss or Full load loss or Both) but remain within acceptable limit. For example : If total no. of transformers to be inspected is 100 and the no. of selected transformers during pre-delivery inspection is 10, 8 nos. are found within the specified losses and 2 nos. are found exceeding the specified losses then the %MT will be (2/10)x100=20%

* 1 Measured Average No Load Loss = [Sum of the measured No-load losses of the tested transformer(s) exceeding the specified No-load loss ÷ Nos. of tested transformer(s) which exceeds the specified No-load loss]

* 2 Measured Average Full Load Loss = [Sum of the measured Full-load losses of the tested transformer(s) which exceeding the specified Full-load loss ÷ Nos. of tested transformer(s) which exceeds the specified Full-load loss]

It is to be noted that if the measured value found less than or equal to specified value, no benefits will be given to the supplier/ manufacturer. In this case, the tested transformers whose loss (No load loss or Full load loss or both) have not exceed the specified loss, will not be taken into account for averaging the measured loss for using the above formula.

7.4.3.6 APPROVAL OF DRAWINGS

Calculation for the Max. Temp. Rise of Winding & Oil over 40^0C ambient supported by Load Losses and Heat Dissipation by Radiator and also Short Circuit Calculation along with thermal & mechanical calculations on the basis of proposed Design Data.

7.4.3.7 TRANSFORMER CORE AND COILS

Transformers core and coils must be new, unused, and clean.

Supporting frames of the core and coils of transformers shall be designed to accommodate variations in tank height.

The core and coil assembly shall have the core and coils rigidly connected to the tank and suitably closed lugs shall be provided for removing the core and coil assembly from the tank.

Transformer Sl. no. should be marked with emboss on the Supporting frames of the core and coils of each transformers minimum in 2(two) places.

7.4.3.8 TRANSFORMER SEALING

A satisfactory lid-sealing gasket shall be provided on each of these transformers to maintain the seal at extremes of operating temperature. A cold oil level (COL) mark shall be provided inside each transformer marked COL.

7.4.3.9 FINISHES

a) Painting

Painting ferrous metal work is to be provided with an effective vapour sealing paint finish, applied generally in accordance with BS 5493 and /or other recognised international standard.

Paint shall be applied to produce a uniform film. Edges corners, crevices, welds, bolts, and rivets shall receive special attention to maintain the required thickness.

Before painting or compound, all un-galvanised parts shall be completely clean and free from rust, scale and grease and all external rough metal surfaces on the casting shall be filled.

The paint system shall be in accordance with best practice for hot and humid locations in a highly aggressive environment. A description of the paint system is to be used and the proposed method of application shall be fully described in the Tender.

All external surfaces shall receive a minimum of three coats of paint. The primary coat shall contain an approved rust inhibitor and shall be applied as soon as possible after the completion of the surface preparation. The second coat shall be of oil and weather resisting nature and have a shade of colour easily distinguishable from the primary. The final coat shall be of oil and weather resisting and non-fading glossy paint of a colour agreed by the Engineer.

b) Non-ferrous parts and Bright Steel parts

All exposed metal liable iron corrosion during transport is to be appropriately protected by casting with an approved anti-rusting composition. Other non-ferrous parts shall be adequately protected against corrosion during shipment or in service.

c)Galvanizing

Galvanizing where applicable shall be applied by the hot dipped process generally in accordance with ASTM A90/ BS EN ISO 1461:1999 or equivalent standard of metal surface unless specified otherwise.

The zinc coating shall be smooth clean and of uniform thickness and free from defects. The preparation of galvanizing itself shall not adversely affect the mechanical properties of the coated material.

All drilling, punching, cutting, shaping and welding of parts shall be completed and all burrs shall be removed before the galvanizing process is applied.

Surfaces that are in contact with oil shall not be galvanized or cadmium plated.

7.4.3.10 RATING PLATE

A brass or stainless steel rating plate shall be fitted to each transformer. The information shall deeply etched including the diagram of the connections of the windings, the vector diagram showing the general phase relations of the transformer, and a diagrammatic plan of the transformer cover showing the terminal positions and marking and other essential particulars. The plate shall be mounted in an accessible position and preferably adjacent to the tapping switch if this is located on the side of the tank.

The rating plate shall be fitted below the LV terminals. Rating and diagram plates shall be attached by a 5 mm brass screw in each corner to 20 mm mild steel brackets welded horizontally approximately 20 mm from the tank side. The following information is to be provided on the rating and diagram plate in the English language – clearly and indelibly marked.

* Transformer type
* Manufacture's name
* Manufacturer's serial number
* Year of Manufacture
* Number of phases
* Rated power
* Rated frequency
* Rated voltages
* Rated currents
* Connection symbol
* Impedance voltage at rated current
* Type of cooling
* Total mass
* Mass of insulating oil
* Insulation levels
* Details regarding tapings

Each Transformer should be marked with emboss or welded on the body easily visible from the ground, with letters of size mentioned against each word(s)/ sentence(s) below:

BPDB (40 mm)

Contract No & Date: (20 mm)

Sl. No.:--------- of ----------KVA ---------- (20 mm)

Note :

a) Sl. No. .....of .....KVA ..... is meant for particular No. of the Transformer out of the contracted quantity under this contract.
b) The above marking on the body of the transformer shall be done in addition to the normal nameplate of the transformer. The nameplate shall be continuous welded on the body of the Transformer before Pre-delivery inspection**.**

7.4.3.11 TERMINAL MARKING

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal. These markings shall preferably be 25 mm in height. The terminal marking shall be embossed on the body of the Transformer with respective color code.

7.4.3.12 TERMINAL LEADS

Outgoing leads shall be brought out through bushings. The leads shall be such that the core and coils may be removed with the least possible interference with these leads, and they shall be specially supported inside the transformer to withstand the effects of vibration and short circuits.

7.4.3.13 BUSHINGS

All bushings shall be porcelain clad, and shall be of the highest quality. They shall be sealed in a manner to prevent ingress of moisture and to facilitate removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing stems, nuts and washers shall be made of brass.

7.4.3.14 EARTHING CONNECTIONS

Earthing connections shall be provided with connection facilities for 2x50 mm2 copper stranded conductor. The bolts shall be located on the lower side of the transformer and be of M12 size; each shall be clearly indicated with an engraved 'earth symbol'. Two earthing connections are required on each transformer.

7.4.3.15 GASKETS

Any gaskets provided with the transformers shall be suitable for making oil tight joints, and there shall be no deleterious effects of either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the material of the gasket is mounted on a textile backing. Exterior gaskets shall be weatherproof and shall not be affected by strong sunlight.

7.4.3.16 TAPINGS

Five voltage tapings shall be provided on the primary side of each transformer and shall give: + 2.5%, 0,- 2.5%, – 5% and –7.5% steps of the primary nominal voltage.

The tapings shall be selected by an 'off load' tapping switch with an external hand wheel with provision for looking onto a selected tapping. The switch shall have a positive action designed to eliminate the possibility of stopping in an intermediate position. The shaft shall be adequately sealed so that no seepage of oil occurs under all conditions of service. The voltage operating positions, together with tap change positions shall be clearly and indelibly marked.

SECTION 7.5

TECHNICAL SPECIFICATION OF POWER CABLES & CONDUCTOR

7.5.1 Power Cables, Conductor and Control Cables

7.5.1.1 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 33 KV, 1CX800 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 33kV XLPE Cu cable. The 33kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 33kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high

conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 800 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0221Ω/KM at 20°C.

Conductor Screen
The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation
The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 8.0 mm.

Insulation Screen
The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.
The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen
The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.
The metallic Screen shall be so designed to carry the specified earth fault current of 40KA for 1 second.

Separation Sheath
The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour
The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath
The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The

properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 2.8 mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

a) Manufacturer's name and/or trade name.
b) Voltage grade viz. 33 kV
c) Cable size (no. of core x conductor cross section).
d) Year of manufacture.
e) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 33KV XLPE, 1-Core, 800 mm² Copper cable

Item No.	Description of Items	Particulars
I	Application	For 33KV, 1-core, XLPE 800 mm² Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	800 mm² 1-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 33KV, XLPE, 1-Core, 800 mm² Copper cable

I	Application	For 33KV, 1-core, XLPE 800 mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	800 mm² 1-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 800 mm² Copper Conductors - Installation instructions

Outdoor Termination Kits for 33KV, XLPE, 1-Core, 800 mm² Copper cable

I	Application	For 33KV, 1-core, XLPE 800 mm² Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	33KV, effectively earthed system
iv	Cable conductor	800 mm² 1-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 800 mm² Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.2 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 33 KV, 1CX500MM2 XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 33kV XLPE Cu cable. The 33kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas

curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 33kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 500 sq. mm.

The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0366 Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)

A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 8.0 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied copper tape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 40KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 2.6 mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

f) Manufacturer's name and/or trade name.
g) Voltage grade viz. 33 kV or 11 kV.
h) Cable size (no. of core x conductor cross section).
i) Year of manufacture.
j) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 33kV XLPE, 1-Core, 500 mm^2 Copper cable

Item No.	Description of Items	Particulars
i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors
ii	Installation	For underground horizontal mounting
iii	System	33KV, effectively earthed system
iv	Cable conductor	500 mm^2 1-core, Copper Conductors
v	Construction	The joint shall be proof against ingress of moisture and water
vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 33kV, XLPE, 1-Core, 500 mm^2 Copper cable

i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors
ii	Installation	For Indoor switchgear terminations
iii	System	33KV, effectively earthed system
iv	Cable conductor	500 mm^2 1-core, Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit

		- Solderless earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Installation instructions

Outdoor Termination Kits for 33kV, XLPE, 1-Core, 500 mm^2 Copper cable

i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	33KV, effectively earthed system
iv	Cable conductor	500 mm^2 1-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.3 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 33 KV, 3CX95 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 33kV XLPE Cu cable. The 33kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 33kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 3X95 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.193Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by

extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 8.0 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 40KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 3.10 mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

k) Manufacturer's name and/or trade name.
l) Voltage grade viz. 33 kV
m) Cable size (no. of core x conductor cross section).
n) Year of manufacture.
o) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 33KV XLPE, 3-Core, 95 mm² Copper cable

Item No.	Description of Items	Particulars
I	Application	For 33KV, 3-core, XLPE 95 mm² Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	95 mm² 3-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 33KV, XLPE, 3-Core, 95 mm² Copper cable

I	Application	For 33KV, 3-core, XLPE 95mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	33KV, effectively earthed system
Iv	Cable conductor	95 mm² 3-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for3X95 mm² Copper Conductors - Installation instructions

Outdoor Termination Kits for 33KV, XLPE, 3-Core, 95mm^2 Copper cable

I	Application	For 33KV, 3-core, XLPE 95 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	33KV, effectively earthed system
iv	Cable conductor	95 mm^2 3-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3X95 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.4 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 11 KV, 1CX630 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 11kV XLPE Cu cable. The 11kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 11kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 630 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0366Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.8 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by

extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 3.8 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 25KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 2.5mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

p) Manufacturer's name and/or trade name.
q) Voltage grade viz. 11 kV
r) Cable size (no. of core x conductor cross section).
s) Year of manufacture.
t) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 11KV XLPE, 1-Core, 630 mm² Copper cable

Item No.	Description of Items	Particulars
I	Application	For 11KV, 1-core, XLPE 630 mm² Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	630 mm² 1-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 11KV, XLPE, 1-Core, 630 mm² Copper cable

I	Application	For 11KV, 1-core, XLPE 630mm² Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	630 mm² 1-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 630 mm² Copper Conductors - Installation instructions

Outdoor Termination Kits for 11KV, XLPE, 1-Core, 630mm^2 Copper cable

I	Application	For 11KV, 1-core, XLPE 630 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	11KV, effectively earthed system
iv	Cable conductor	630 mm^2 1-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 630 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.5 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF 11 KV, 3CX185 SQ.MM XLPE CU CABLE WITH TERMINATION KIT

The manufacturing process shall be designed to eliminate irregularities like protrusions, voids and contamination etc. to ensure the long-term reliability of the 11kV XLPE Cu cable. The 11kV XLPE Cu cable covered in this specification shall be manufactured by Triple extrusion and Gas curing process ensuring circularity and concentricity of the extruded layers around the conductor and all three layers (conductor screen, XLPE insulation and insulation screen) shall be extruded in simultaneous triple extrusion process. The details of manufacturing process and curing to be adopted shall be mentioned clearly in the offer.

Raw materials used to manufacture the cable shall be of highest quality and it should meet material standards mentioned in IEC 60 502-2. The materials shall be clean and packed in moisture and dust proof packing. Material received by manufacturer should be checked/ tested to ensure that it meets material specification.

Loading of the extruder in the manufacturing plant shall be performed entirely closed and dust proof environment. Contamination shall be avoided by the use of a fully enclosed material handling system. The use of special means like pressurized air etc. for transport of granules, as far as practicable, shall be avoided.

The cross linking, curing and cooling may be carried out in one operation and shall be a gas curing process under high pressure to eliminate the formation of voids in the insulation and

contaminants in the dielectric. Process conditions such as curing and cooling temperatures, production speed etc. shall be closely monitored during manufacture to ensure a good degree of cross-linking through the whole insulation.

The cable will be laid in underground in an area with highly moist soil so metal sheath of either lead or aluminium shall be employed to act as moisture barrier layer.

Cable Construction

The 11kV XLPE Cable shall have stranded compacted round copper conductor, taped with semi conducting tapes, conductor screening with extruded semi conducting thermosetting compound, with completely gas cured XLPE insulation, adequate insulation screening consisting of extruded semi conducting thermosetting compound layer, taped with semi conducting water swellable tape, extruded/welded corrugated Aluminium sheathed and overall extruded termite repellent black PE sheathed with outer conducting layer.

Conductor

The conductor shall be stranded compacted round copper conductor complying the requirement of flexibility Class-2 of IEC 60 228. The wires shall be made of high conductivity copper and shall be stranded mid compacted. The copper used for the conductor shall be of highest purity. The nominal area of conductor shall be 3X185 sq. mm.
The minimum number of wires in conductor shall be 61 and the maximum DC resistance of conductor shall be 0.0991Ω/KM at 20°C.

Conductor Screen

The conductor screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface of the conductor. The screen shall be firmly bonded to XLPE insulation. The minimum thickness of conductor screen shall be 0.5 mm. (approx.)
A non-hygroscopic semi conducting tape may be applied over the conductor surface under extruded layer. The outer surface of the conductor screen shall be circular and free from irregularities.

Insulation

The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirement as per IEC 60 502-2. The insulation shall be applied by extrusion and vulcanisation to form a compact homogenous body free from micro voids and contaminants. The nominal thickness of insulation shall be 3.4 mm.

Insulation Screen

The insulation screen shall consist of an extruded layer of thermosetting semi conducting compound and shall be continuous and cover the whole surface area of insulation. It shall be firmly bonded to the insulation.

The minimum thickness of insulation screen shall be 0.5 mm.

Metallic Screen

The metallic Screen shall consist of a concentric layer of copper wires or a combination of copper wires and helically applied coppertape(s) as per IEC Standard.

The metallic Screen shall be so designed to carry the specified earth fault current of 25KA for 1 second.

Separation Sheath

The Separation Sheath should covering the whole surface area of the metallic screen as per IEC Standard.

Armour

The armour shall be Aluminium Alloy round wires or Corrugated Aluminum sheath as per IEC Standard.

Outer sheath

The outer sheath shall consist of an extruded layer of black medium density polyethylene. The outer sheath shall be of sufficient hardness to discourage termite attacks. The properties of outer sheath material shall be as per IEC 60 840. The nominal thickness of outer sheath shall be 3.1mm.

Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

u) Manufacturer's name and/or trade name.
v) Voltage grade viz. 11 kV
w) Cable size (no. of core x conductor cross section).
x) Year of manufacture.
y) Purchaser's name i.e. BPDB.

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm. In case of printed over a tape, the same shall be provided inside the cable.

Straight-through joint box for 11KV XLPE, 3-Core, 185 mm² Copper cable

Item No.	Description of Items	Particulars

I	Application	For 11KV, 3-core, XLPE 185 mm^2 Copper Conductors
Ii	Installation	For underground horizontal mounting
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	185 mm^2 3-core, Copper Conductors
V	Construction	The joint shall be proof against ingress of moisture and water
Vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions

Indoor Termination Kits for 11KV, XLPE, 3-Core, 185mm^2 Copper cable

I	Application	For 11KV, 3-core, XLPE 185mm^2 Copper Conductors
Ii	Installation	For Indoor switchgear terminations
Iii	System	11KV, effectively earthed system
Iv	Cable conductor	185 mm^2 3-core, Copper Conductors
V	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3x185 mm^2 Copper Conductors - Installation instructions

Outdoor Termination Kits for 11KV, XLPE, 3-Core, 185mm^2 Copper cable

I	Application	For 11KV, 3-core, XLPE 185 mm^2 Copper Conductors
ii	Installation	For outdoor installation on poles/structures
iii	System	11KV, effectively earthed system
iv	Cable conductor	185 mm^2 3-core Copper Conductors
v	Kit content	- Heat shrinkable high voltage insulating and non-tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3X180 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions

7.5.1.6 Tests for All 33kV & 11kV XLPE Power Cables .

All type, routine and acceptance (special) tests shall be carried out as per IEC 60 502-2. The manufacturer of cable must have at least ISO 9001 certified quality Assurance system in their manufacturing system.

Routine Tests

The following routine tests shall be carried out on each manufactured length

a) Partial discharge test
b) Voltage test
c) DC voltage test on outer sheath
d) Conductor resistance test

Special (Acceptance) Tests

The following tests shall be made on samples which, for the tests in items (b) and (g), may be on complete drum length of cable taken to represent batches

a) Conductor examination
b) Measurement of electrical resistance of conductor
c) Measurement of thickness of insulation and non-metallic sheath
d) Measurement of thickness of metallic sheath
e) Measurement of overall cable diameter
f) Hot set test for XLPE insulation
g) Measurement of capacitance

Frequency of Tests

The above special (acceptance) tests shall be made on one length from each manufacturing series of the same type size of cable, but shall be limited to not more than 10% of the number of lengths in any contract, rounded to upper unity.

Type Tests

The following tests shall be included in the type tests (Electrical) Tests.

a) Bending test followed by Partial discharge test
b) Tan δ measurement
c) Heating cycle test followed by partial discharge measurement
d) Impulse withstand test followed by a power frequency voltage test

Test on cable components

a) Check for cable construction
b) Resistivity of semi conducting layers
c) Test for determining the mechanical properties of insulation before and after ageing
d) Test for determining the mechanical properties of non-metallic sheath before and after ageing.
e) Ageing tests on pieces of complete cable to check compatibility of materials
f) Pressure test at high temperature on sheath
g) Hot set test on XLPE insulation
h) Carbon black content of PE sheath
i) Shrinkage test on XLPE insulation.

7.5.1.7 Technical Orientation and Quality Test Witness of XLPE Power cable:

The Purchaser shall have the right to inspect/test the goods/materials to confirm their conformity to the specification. The purchaser shall be entitled at all reasonable time during manufacture to inspect, examine and test of goods/materials at the manufacturers' premises, workmanship and performance.

At least the following test along with routine test shall be carried out as per latest version of IEC Standard or equivalent IEEE standard or BS standard unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available:-

1. MeasurementofElectricalResistanceofconducts.
2. Highn voltagetest
3. Partialdischargetest
4. Capacitancetest
5. Voltagetestoncableserving
6. Measurement of dimension of insulation and conductor

The Supplier shall, after consulting the purchaser, give the Purchaser reasonable notice in writing of the date on and the place at which any material or equipment will be ready for testing as provided in the contract and unless the purchaser shall attend at the place so named on date, which the supplier has stated in his notice, the supplier may proceed with the tests, which shall be deemed

to have been made in the purchaser's presence, and shall forth with forward to the purchaser duly certified copies of test readings.

When the purchaser intends to attend the test he shall promptly inform the supplier accordingly in writing, so that he can take action. The purchaser shall give the supplier timely notice in writing of his intention to attend the test. The contractor shall submit the factory test report to the engineer for check and verification at least 15 days prior to inspection.

Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These test shall be performed as per relevant IEC Standard or equivalent IEEE standard or BS standard only routine tests as agreed upon, will be performed.

As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect. Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the item or complete batch if necessary. In that case Supplier have to replace the Equipment and to make good of them without any financial involvement to the Purchaser. In case any of the Equipment found not conforming with the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

7.5.1.8 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF0.4 kV, 4x185 mm² PVC Copper Cable

GENERAL SPECIFICATIONS :

These single core cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The maximum acceptable length of cable on a drum shall be 500M and shall be supplied on standard non-returnable treated wooden drum, each drum having stenciled on each side: drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.
Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Conductors shall be circular plain annealed copper in accordance with IEC 60228. Thickness of insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A means of identifying the cable size and BPDB ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name with year of manufacture and Progressive Meter Marking shall be provided throughout the length of the cable.

Drum wound length of each drum may vary up to ± 5% of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

Description	Unit	Requirements
Cable Size	mm^2	4CX185
Material		PVC Insulated plain annealed copper.
Numbers & Diameter of wires	No/mm	30/To be mention
Maximum resistance at 30 °C	Ω/KM	0.1010
Nominal thickness of insulation	Mm	2.0
Nominal thickness of sheath	Mm	2.8
Co lour of sheath		Black
Approximate outer diameter	Mm	56.30
Approximate weight	Kg/KM	8725
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	330
Current rating at 35 °C ambient in air	Amps	350

FEATURES AND ACCESSORIES:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminium water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate without undue deterioration.
- The PVC covering shall be complete with PVC/A for Insulation and PVC-ST2 for Sheath as per requirement of IEC60502-1.
- There shall be only one length of conductor on a drum.

- Treated wooden drum standard: AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.

INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.
b) Cross-sectional drawings of offered cable.
c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

7.5.1.9 SPECIFICATION FOR COPPER CONTROL CABLE

7.5.25.1 STANDARDS:

The cable as specified in this Section shall be conforming to the latest edition of the following standards for operation under local ambient conditions. Design, Manufacture, Testing and Performance of the cable shall be in accordance with the IEC 502-1, BS 6004:1994 or equivalent International standards.

7.5.25.2 SPECIFICATIONS:

These cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The maximum acceptable length of cable on a drum shall be 1000M and shall be supplied on standard non-returnable treated wooden drum, each drum having stencilled on each side, drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Thickness of PVC insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A mean of identifying the cable size and BPDB ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name shall be provided throughout the length of the cable with year of manufacture.

Drum wound length of each drum may vary up to ± 5% of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

Description	Unit	Requirements					
Cable Size	mm^2	4CX2.5 mm^2	4CX4mm^2	4CX6mm^2	8CX2.5 mm^2	16CX2.5 mm^2	24CX2.5 mm^2
Material		plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper
Numbers & Diameter of wires	No/mm	7/0.67	7/0.85	7/1.04	7/0.67	7/0.67	7/0.67
Diameter of Steel wires/ Strips	mm	1.4	4×0.8	4×0.8	4x0.8	4x0.8	4x0.8
Thickness of Steel Tape	mm	-	0.25	0.25	0.25	0.25	0.25
Maximum resistance at 30 °C	Ω/KM	7.28	3.20	3.20	7.69	7.69	7.69
Nominal thickness of PVC insulation	mm	0.8 (min.)	1.0 (min.)	1.0 (min.)	0.8 (min.)	0.8 (min.)	0.8 (min.)
Nominal thickness of PVC sheath	mm	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)
Co lour of sheath		Black	Black	Black	Black	Black	Black
Approximate outer diameter	mm	17	20	21	20	25	28
Approximate weight	Kg/KM	670	810	920	1040	1630	1730
Continuous permissible service voltage	V	600/1000	600/1000	600/1000	600/1000	600/1000	600/1000

7.5.25.3 FEATURES AND ACCESSORIES:

- Cables shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameters. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminum water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop

metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate without undue deterioration.

- There shall be only one length of cable on a drum.
- Treated wooden drum standard: AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.

7.5.25.4INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.
b) Cross-sectional drawings of offered cable.
c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.
d) Manufacturer's valid ISO 9001 Certificate.

7.5.1.10 TECHNICAL SPECIFICATIONS/REQUIREMENTS OF All Control Cable XLPE Insulated Armoured Copper Cable

7.1.4 STANDARDS:

The cable as specified in this Section shall be conforming to the latest edition of the following standards for operation under local ambient conditions. Design, Manufacture, Testing and Performance of the cable shall be in accordance with the IEC 502-1, IEC 60228, BS 6004:1994 or equivalent International standards.

7.1.5 SPECIFICATIONS:

These All Control cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The acceptable length of cable on a drum shall be 1000M and shall be supplied on standard non-returnable treated wooden drum, each drum having stenciled on each side : drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Conductors shall be circular plain annealed copper in accordance with IEC 60228. The armoured shall be round Aluminium Wire.Thickness of insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A means of identifying the cable size and BPDB ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name with year of manufacture and Progressive Meter Marking shall be provided throughout the length of the cable.
The insulation shall be cross-linked polyethylene (XLPE). The insulation material shall comply with the requirements as per IEC-60502-2. The insulation shall be applied by extrusion and vulcanization to form a compact homogeneous body free from micro voids and contaminates.

7.1.6 FEATURES AND ACCESSORIES:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminium water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- The PVC covering shall be complete with PVC/A for Insulation and PVC-ST2 for Sheath as per requirement of IEC60502-1.
- There shall be only one length of conductor on a drum.
- Treated wooden drum standard: AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.

7.1.7 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.

b) Cross-sectional drawings of offered cable.

c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

d) Manufacturer's valid ISO 9001 Certificate.

7.1.8 Type Test

Type Test Reports for XLPE Insulated and PVC sheathed Copper cable (4CX4mm^2) from an independent testing Laboratory/ Institute as per relevant Standards (unless otherwise specified).

7.1.9 Marking on Outer Sheath

The following particulars shall be either marked on Cable outer sheath or printed over a tape at suitable regular intervals.

z) Manufacturer's name and/or trade name.
aa) Cable size (no. of core x conductor cross section).
bb) Year of manufacture.

cc) Purchaser's name i.e. BPDB.
dd) Meter Marking (PVC cable should carry a meter mark)

The spacing between one set of marking and lie beginning of the next on the legend shall not exceed 300 mm.

In case of printed over a tape, the same shall be provided inside the cable.

Note: No negative tolerances for the diameter and thickness are acceptable

4CX2.5mm² XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm²	**4CX2.5mm²**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	3.20
Nominal thickness of insulation	mm	0.80
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	18
Approximate weight	Kg/KM	670
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	34
Current rating at 35 °C ambient in air	Amps	31

4CX4mm² XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm²	**4CX4mm²**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.85
Maximum resistance at 20 °C	Ω/KM	4.61
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black

Approximate outer diameter	mm	18.4
Approximate weight	Kg/KM	720
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	34
Current rating at 35 °C ambient in air	Amps	31

4CX6mm^2 XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**4CX6mm^2**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/1.04
Maximum resistance at 20 °C	Ω/KM	3.08
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	19.80
Approximate weight	Kg/KM	860
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	64
Current rating at 35 °C ambient in air	Amps	56

8CX2.5mm^2 XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**8CX2.5mm^2**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	7.69
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	20
Approximate weight	Kg/KM	1040
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	64
Current rating at 35 °C ambient in air	Amps	56

16CX2.5mm^2 XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**16CX2.5mm^2**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	7.41
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	25.00
Approximate weight	Kg/KM	1260
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	15
Current rating at 35 °C ambient in air	Amps	12

24CX2.5mm^2 XLPE Insulated Armoured Copper Cable

Description	Unit	Requirements
Cable Size	mm^2	**16CX2.5mm^2**
Material		XLPE Insulated and PVC sheathed Armoured Copper Cable
Numbers & Diameter of wires	No/mm	7/0.67
Maximum resistance at 20 °C	Ω/KM	7.69
Nominal thickness of insulation	mm	0.70
Nominal thickness of sheath	mm	1.8
Co lour of sheath		Black
Approximate outer diameter	mm	28.00
Approximate weight	Kg/KM	1730
Continuous permissible service voltage	V	600/1000
Current rating at 30 °C ambient temperature U/G	Amps	15
Current rating at 35 °C ambient in air	Amps	12

7.6 CIVIL AND ARCHITECTURE

7.6.1 References

7.6.1.1 General

The design and construction shall conform to the latest edition of the relevant codes and standards. Any proposed substitution for the listed standards by an equivalent standard will be subject to approval by the Engineer. Relevant standards include.

7.6.1.2 Design and Construction Standards

BS 12	Portland Cement
BS EN 124	Gully and Manhole tops for vehicular and pedestrian areas
BS 812	Testing Aggregates
BS 882	Aggregates from natural sources for concrete
BS 1377	Methods of test for soil for civil Engineering purposes
BS 1722:Part10	Anti-intruder fences
BS 1881	Testing concrete
BS 2853	Design and testing of overhead runway beams
BS 3148	Methods of test for water for making concrete
BS 3921	Clay bricks
BS 4449	Steel bars for the reinforcement of concrete
BS 5262	External renderings
BS 5395	Stairs, ladders and walkways
BS 5572	Sanitary pipe works
BS 5628	Code of practice for use of masonry
BS 5930	Code of practice for site investigations
BS 6031	Code of practice for earth works
BS 6367	Code of practice for drainage of roofs and paved areas
BS 6399: Part1	Code of practice for dead and imposed loads
BS 6399: Part 2	Code of practice for wind loads
BS 6465	Sanitary installations
BS 6651	Code of practice for protection of structures against lightning
BS 6700	Design, installation, testing and maintenance of services supplying water for domestic use.
BS 8004	Code of practice for foundations
BS 8005	Sewerage
BS 8100	Lattice towers and masts
BS 8102	Code practice of protection of structures against water the ground structural use of concrete.
BS 8110	Structural use of concrete
BS 820	Lightning of buildings

BS 8215	Code practice for design and installation of damp-proof courses in masonry
BS 8290	Suspended ceilings
Bs 8301	Code of practice for Building drainage

7.6.1.3 STANDARDS AND CODES OF PRACTICE

The engineering & execution of all Civil, Structural & Architectural works shall be based on the latest edition or revision of the applicable portion of the following Codes and Specifications. In case any particular aspect of work is not covered by these Standards, other standard specifications, as may be specified by the Engineer, shall be followed.

a) The Bureau of British Standard Codes.
b) National building Code of Bangladesh
c) Environmental protection agency
d) American Codes and standards (ASTM, ACI,)
e) Local Statutory regulations
f) Rules & Regulations of local authorities

The Civil Works shall be designed and constructed in accordance with the Specifications, relevant Standards and Codes of Practice approved by the Engineer. Local code of practice shall be followed where not mentioned. The Contractor shall submit together with his bid a schedule of standards and codes of practice to be followed in the design and construction of the Works. Copies of these codes and standards shall be made available to the Engineer during the design and construction period. In the case of the Standards and Codes not published in English, the Contractor shall obtain English translations when required and send them to the Engineer.

The Contractor shall be responsible for the establishment of design parameters to satisfy the requirement of the project.

Basic design conditions shall be as follows: -

a.	Seismic coefficient at Ground Level (Horizontal) (PGA)	:	Sysmic Zone-3, Zone coefficient, Z=0.25 (as per BNBC, 2020).
b.	Design Storm	:	Based on frequency-intensity Duration curves prepared for Rangamati Zone
c.	Wind velocity	:	217m/s
d.	Design load for road	:	H-20-S16-44 (AASHO)
e.	Standards and codes of practice	:	ASTM, ACI, BNBC and inter-national codes of practice and other Standards to be approved by the Engineer

7.6.2 Design

Both Architectural and Structural Design shall be submitted by the contractor to the employer for approval.

7.6.2.1 Architectural and structural Requirements of Buildings

The details Architectural, Structural & other related drawing and design with Green Building concept shall be submitted by the contractor to employer for approval.

1. **Structure** : Modern Architectural designed R.C.C or Steel Framed Structure featured by Green Building Technology.

2. **Partition Wall :**
   - For all Exterior wall thickness should be 10 (ten) inches and interior wall thickness should be 5 (five) inches and to be used 1st Class Bricks.
   - All Brick wall should be plastered both sides as per standard (Except where Fare-Facing Treatment to be used)
   - In case of R.C.C. works 20mm down graded Stone chips should be used.

3. **Covered Area** : Minimum required area in Building are included with service areas & Other Specific Functions - Control Room, Battery room, Cable Trench, Store, Office Rooms, walkway, open Space & stair case etc.

4. **Foundation** : **For GIS Sub-station- with X-former outside**

Considering 02 storied building (no Basement) (G+1) with 04 (four) storied foundation

- Plinth Level at +3ft above from Ground Level
- Ground Floor clear height 10'-6" ft Cable Trench & Ancillary Facility
- 1st Floor clear height 14'-6" ft for Control room

For GIS Sub-station- with X-former ground floor

Considering 3 storied building (no Basement) (G+2) with 04 (four) storied foundation

- Plinth Level at +3ft above from Ground Level
- Ground Floor clear height 24'-6" ft or as per Power Transformer Installation Height
- 1st Floor clear height 10'-6" ft for Cable Trench & Ancillary Facility
- 2nd Floor clear height 14'-6" ft for Control room

5. **Floor/Roof Finish :**
   - To be used 24 inch x 24 inch size European standard Mirror Polished Homogeneous tiles for 1st 2nd Floor.
   - Standard Quality Tiles for walk way or other common space.

6. **Toilet/ Sanitary:**
   - Floor and full height wall of the Toilet should be furnished by European Standard Tiles with decorative boarder. Floor tiles should be non-slippery.

- To be used European Standard Commode, Basin and others Sanitary Fittings & Fixtures (such as Pillar Cock, Bib Cock, Push Shower etc.) should be European Standard as well as approved sample and design.
- To be Constructed 50 users septic tank, inspection pit, sewerage line, apron, drain etc.
- To be provided water supply system with Deep Tube well & over head water tank.

7. **Electrical Fittings & Fixture :**
   - Concealed Electrical wiring by Eastern/BRB/Paradise Fire Resistant Cable
   - European Made MK type Gang switch, socket MCB etc
   - Provision for Internet facilities system, Dish Line, Telephone & Intercom wiring.
   - Sufficient Earthling facilities.
   - To be used LED Light
   - To be provided sufficient Air Conditioner
   - To be provided sufficient Ceiling Fan

8. **Interior Wall Finishing** : Smooth Finished & soft colored Plastic paint should be used over the Plastering work of interior wall and ceiling.

9. **Exterior Wall** : Smooth Finished & Architectural approved colored weather coat should be used over the Plastering work of Exterior wall. Some where should be used Ceramic Facing brick / Rustic Tiles

10. **Window** : Window should be made Standard Quality Thai Aluminum frame and minimum 5mm thickness glass using U.S (AAMA) Standard.

11. **Door** : Door Frame and Shutter should be made by solid wood such as Burma Teak, Teak Chambal, Chapalish etc. which shall be approved by the owner's engineer.

12. **Stair Railing** : Should be used approved designed SS Railing in the Stair case.

13. **Sign, Signal & Annotation :**
    - Integrated Design of Different kind of Indicators like- Acrylic Sign Board, LED Sign Board, Neon Sign Board, Reception Sign Board, Safety Sign, PVC Letters, Glow Sign Board, Customized Display Boards, Overhead Signage, Metal Nameplates, Commercial Sign Boards, Outdoor Signs, Electronic Sign Boards etc. should be provided in the design & construction.
    - Digital LED Signboard with the features of- Excellent visibility (even in daylight); Good quality at reasonable price and light weight; Simple installation, Safe to touch and clean; Changing color for attracting attention; Extremely low

power consumption.

- Should be provided the Accessories like Adaptor and chains etc.

14. **Approval & Test** **:** Over all Approval should be taken from concern office of the BPDB. Materials & Item (if required) should be tested from any authorized Institutions of Bangladesh furnished by the Contractor.

The columns of the ground story shall be extended above roof level to permit starter bars to be left in place for a future story. An external concrete open staircase shall be provided up to the roof for AIS Sub-stations. The roof shall be a RCC slab designed for 5.5 kN/m^2 for control room floor and for roof live load for all floor as per BNBC-2006. If a future story is not required, a fixed ladder of galvanized steel shall be provided up to the roof or provide temporary CI sheet shade over the stair case as per direction of the employer.

The main entrance to all buildings shall be shaded, either by a projection of the roof over the entrance verandah or by a separate roof at a lower level. This area of roof shall also be lime terraced and drained by rainwater pipes.

The head of each down pipe shall be fitted with an enlarged hopper and purpose made cast iron grill set into recess in the roof projection.

Window openings shall be fitted with protruding concrete sunshades above and at the sides of the openings.

All external walls shall be 250 mm first class brick work also provide 237.5mm x 68.75mm x 12.5mm (9.5”x2.75”x0.5”) or any other standard sizes of Mirpur ceramics facing bricks or similar approved, or rendered Rustic Tiles as required by the architectural plan. The internal walls shall be generally of 125 mm thick first class brick work. Internal walls shall all be rendered and receive one sealer coat plus two finishing coats of Plastic emulsion paint. All brickwork shall be tied into the RCC frame by galvanized ties.

Externally, rendered walls shall receive primer plus two finishing coats of PEP acrylic external quality paint or similar approved.

The height of control rooms shall be provided about 1 (One) meter clearance over the top of the cabinets to the underside of the false ceiling. In the switch gear rooms, about 1 meter clearance shall be provided over the switch gear to the underside roof slab but the Contractor shall provide a greater clearance if it is required to remove equipment. The clearance may be reduced below down stand beams provided no equipment is required to be removed from the top of the switch gear. All rooms in any building shall be one height.

Control buildings housing switch gear and control equipment shall include a cable basement to facilitates connection to the equipment. Basements shall be constructed so as to protect the building sub structure from water in accordance with BS 8102.

Power cable and "Control and communication cables" shall have totally different Cable tray and trench in the cable compartment and anywhere else. The location of both tray and trench shall be such like that if power cable has any flashing/ or fire event there shall be no provision for damage of control cable

Substation control Building lightning protection shall be provided by Large Lightning post beside control building or spiked type lightning arrester at the rooftop.

Provision for Fire fitting & fixture for Installation of fire equipment, fire detection, fire protection etc. Control room building should have the standard sized fire exit/scape with facilities and the fire scape should be designed according to floor area accommodation.

7.6.2.2 Ground conditions, Foundations and Site Investigation

(a) Fill Sites

On fill sites where the depth of fill exceeds 3 meters the contract assumes piled foundations shall be installed below buildings. If placed foundations are found to be unnecessary in the final site investigation report, a reduction in contract value shall be agreed on the basis of schedule rates.

Piles shall be concrete (cast in situ or pre-cast) complying with BS 8004. Where timber piles are used, adequate strip footings shall be provided to support the building after the timber piles have deteriorated by which time settlement will be complete.

On every fill site the Contractor shall prove that his switchyard foundation will not suffer settlement greater than 20 mm by constructing a foundation and load testing this to twice the design bearing pressure for a minimum of 20 days.

Outdoor equipment shall be provided with spread footings. The Contractor will be provided by the Employer with a survey of soil levels prior to filling. The Contractor shall impose the site layout on the survey to check for uneven depth of fill below any foundation and where uneven depth of fill exists his foundation proposals shall restrict final differential settlement to a 1 in 400 slopes.

If a fill site has not been exposed to one wet season before foundation work starts, the Contractor shall flood the site to a depth of 50 mm for 10 days (Not required on hydraulic fill site). This requirement is because silty sands will generally compact to a denser condition on first time flooding.

On all fill sites the Contractor shall pipe rainwater from pipes down to paddy level and shall prevent water pond in open foundations and backfill all foundations as soon as possible.

The Contractor shall monitor settlement of the fill (by placing concrete posts 50x50x750 mm deep on a 10 meter grid and taking readings) at 30 day intervals from the time he is given access to each fill site.

When a fill site is handed over to the Contractor, The Contractor shall become responsible for maintaining the entirely of the fill in good condition, including all batter slopes.

(b) Unfilled Sites

Original delta levels are generally 4 meters below road level. Therefore most sites are historically fill sites but fill settlement can sensibly be considered complete, where fill is over 3 years old.

(c) Site Investigation

The Contractor may appoint a sub contractor to carry out the site investigations but all work and all lab work shall be witnessed by one of his own staff who shall countersign all recorded data.
The site investigations and analysis of the data in a final report giving full details of foundation proposals shall be completed at each site by the programmed date.

Boreholes shall be taken on a 25 meter grid with at least three additional boreholes beside each building. Additional boreholes may also be required where uneven fill depth is encountered. The boreholes shall be located to an accuracy of ±0.5 m and shall be located to site layout.

Boreholes shall be a minimum of 20 meters depth or twice building footing width, whichever is greater or as per site condition & decision of the employer. All boreholes shall be back filled with compacted sand.

In each bore hole the following tests shall be carried out :

Standard penetration tests at 1.5 meter intervals.

Undisturbed samples shall be taken at around 1.5 meters depth and 3 meters depth and tested by unconfined compression tests.

One dimensional consolidation tests shall be carried out on undisturbed samples taken at 1,5,3 and 4.5 meters depth. The samples shall be saturated and the range of applied pressure shall fully reflected the in situ conditions. Graphs showing void ratio(e) and applied pressure shall be submitted along with the coefficient of compressibility for the range of loading anticipated. Mv shall be in m^2/MN and shall be recorded at each stress increment. The coefficient of consolidation, cv, shall be given in m^2/year.

Particle size analysis shall be carried out for each stratum and specified gravity, moisture content, liquid limit and plastic limit determined.

Ground water level shall be determined by dipping the boreholes. Where collapse of the boreholes occurs, casing shall be used and left in until the water level remains constant for two days.

In cohesive soils a vane test to BS1377 : part 9 shall be carried out at three different depths. The Contractor shall check the aggressively of soil and ground water at each site to concrete and take all measures necessary to ensure the long term durability of concrete.

(d) Site Investigation Report

The report shall be submitted by the key date at each site given in the program. The Contractor shall submit 2 copies of the report to the Engineer. The report shall propose full details of foundations and loading thereon and shall provide estimates of likely settlements and differential settlements. The report shall be the work of the Contractor’s own foundation Engineers.

If the Contractor uses a local site investigation contractor, he shall appoint one of his own staff to oversee the entire operation and each piece of data shall be countersigned by this person.

The Contractor shall supply, install and test at least one of the types of Pile in accordance with the approved design and the drawing showing the Piling arrangement. Each Pile shall be suite existing the sub-strata at the site.

(e) Foundations

The minimum depth of all foundations shall be :

(i)	Transformer bases bound	1.5 m
(ii)	All other switchyard foundations	1.1 m
(iii)	Control building foundations, including all wall foundations and internal wall foundations	1.5 m
(iv)	Boundary wall foundations	1.1 m

All formations shall be hand rammed or mechanically compacted before placing 70 mm minimum thickness of Class B concrete blinding, within 24 hours of bottoming excavation, which blinding shall project 300 mm minimum distance beyond all footings. Each footing shall be inspected by the Engineer. Where soil condition is poor (on fill sites or already filled sites) or where the Contractor leaves foundations exposed and soil conditions deteriorate, one of the following measures shall be carried out as agreed with the engineer.

(i) Blinding depth and projection shall be increased

(ii) Soft soil shall be removed and replaced with compacted viti sand with the top 200 mm consisting of viti sand and brick chips.

The cost of this work shall be borne by the Contractor.

Between column footings all walls, including all internal wall shall be provided with a reinforced concrete strip footing of minimum dimension 800 mm wide by 250 mm deep placed at the same level as column footings and linked structurally to the footings. In addition column footings shall be tied at foundation level and also floor level by beams to every adjacent column in both orthogonal directions. These beam shall be designed to resist 1 in 200 differential settlement without distress and shall be capable of resisting the earthquake load of Chattogram region as per BNBC 2020

The deepest parts of any foundations shall be completed first. All foundations shall be completed and back filled, including all cable tunnel and cable trench work inside buildings, before walls are raised above floor levels. All other foundations shall be back filled within 7 days of completing concerning.

All exposed concrete and outer surfaces of cable trenches and cable tunnels shall receive two coats of bitumastic paint before back filling to reduce ingress of water. The Concrete surface shall be ground smooth and all air holes etc. filled (rubbed down with a cement slurry) before painting.

The Contractor shall monitor settlement of all foundations each month and report this settlement to the Engineer until settlement has reduced to less than 1.5 mm in 3 months.

The tops of all foundations shall terminate 1000mm above site average finished surface level. All exposed edges shall have 20 mm x 20 mm chamfers.

Excavation shall only be carried out when the ground water table at least 1000mm below foundation level. The excavation shall be kept dry during the construction period by providing sumps and pumps as required. During the rain season, shelters shall be erected over all open excavations.

Any over excavation shall be filled with Class B concrete.

All back fill shall be completed to 95% maximum dry density as defined by BS 1377 test method. 2.5 Kg rammer.
Before starting foundation work the Contractor shall clear all sites of trees, tree roots shrubs, debris, surplus soil, and any buildings.

Foundations shall be designed to resist uplift, assuming the water table is at ground level and the weight of soil resting on a foundation is that included within a 15^0 frustum.

On fill sites where the depth of fill exceeds 3 meters, the Contractor shall provide piled foundations in accordance with BS 8004 for control buildings. If timber piles are used, adequate strip footings shall be provided to support the structure after the timber pile has deteriorated, by which time the fill will be fully consolidated. One working pile chosen by the Engineer shall be load tested at each site to 150% of design load in accordance with BS 8004.

7.6.2.3 Drainage

The entire surface within boundary walls shall be of uniform sloping site, sloping at q in 150 minimum slope to open channels around the entire perimeter. These channels shall be designed for a rainfall intensity of 60 mm per hour. Out side the boundary wall the contractor shall be responsible for drainage up to 20 meters from the wall and will at some sites need to construct outlets with suitable erosion protection down to paddy level.

The concrete wall of cable trenches shall project at least 70 mm above brick paving level to prevent run off entering the cable trench. The floors of all cable trenches /tunnels shall be sloped to soak ways.

The cable trenches shall be free from surface water drainage. If the cutoff area exceeds 30 m^2 it shall be drained by a 200 mm minimum diameter concrete pipe to the boundary drain. The Contractor's drainage design shall avoid all pond water to avoid forming a mosquito breeding ground .
All drainage pipe work within buildings shall be ductile iron, generally of 100 mm diameter. Floor drains shall be placed in each battery room and toilet.

External Pipe work shall be 150 mm minimum diameter concrete pipes at a minimum depth of invert of 700 mm. Where pipes, including existing pipes along with site, are less than 400 mm above adjacent foundations they shall be surrounded in concrete. Where required, drainage pipes shall be kept below cables, allowing 1.1 m cover to top of pipes.

Manholes shall be of brick construction with 600mm x 600mm clear openings and air tight ductile iron covers to BS EN 124. Manholes shall be located at each change of direction. Minimum fall on all pipelines shall be 1 in 80. Manhole shall not be located in roads.

The Contractor shall be responsible for all negotiations with local authority WASA where a connection to a public sewer is proposed. Where high water levels in public sewers may cause effluent to back up into a site, non return valves shall be fitted. The Contractor shall provide all protection required to existing sewers and shall deepen foundations, including boundary wall foundations, where required all foundations are below adjacent sewers. The Contractor shall draw longitudinal sections of all pipelines.
Each control building shall be provided with a septic tank designed for 50 users and a soak away of open brick construction 10 m deep by 2.2 m diameter filled with broken bricks. The septic tank shall be located at least 15 meters from buildings. Other buildings shall have septic tanks designed for the required number of users. All foul drains shall vented by a vent pipi to above roof level. The inner surface od all manholes and septic tanks shall be painted with 2 coats of bitumastic paint to protect it against sulphate attack. The septic tank shall have access holes directly over the inlet pipes and outlet pipes. Where public sewers exist alongside a site, the Contractor shall connect directly to the foul sewer, provided effluent from the sewer is treated.

The Contractor shall construct the drainage first to ensure that at no stage is rainwater ponded on any part of the site. All rainwater shall be able to run off the site or shall be immediately pumped off site by the Contractor. The Contractor shall complete all necessary drains before casting any roof and large concrete area which will create large run off. The condensate drains for the air conditioning shall also be connected to the drainage. Two vents of minimum height 2.2 m shall be provided on each septic tank.

If a town's water supply is unreliable, the roof rain water shall be collected in an underground tank of standard Employer's design. Scope of this work shall be agreed at Bid stage.

7.6.3 Earth Work

7.6.3.1 Scope

This clause covers the performance of all works in connection with the required excavation for the various type of foundations and equipment, as shown in the drawing, or any other excavation and banking that may be necessary during the progress of works including the removal, use or disposal of all excavated materials.

7.6.3.2 Clearing

(1) Clearing shall mean include the remove of trees and shrubs, stumps and other objectionable matters from the area necessary for the works. The contractor shall cut and remove them from the project area or turn them as approved by the Engineer.

(2) By no means shall the contractor fell any trees outside the premise of the construction site without permission of the parties concerned even if such trees cause obstacle against smooth execution of the work. Therefore, any such trees shall be felled upon negotiation with and permission of the possessor.

7.6.3.3 Excavation

(1) Excavation under this section shall consist of the removal, hauling, dumping and satisfactory disposal of all materials from required excavations.

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

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

(4) During excavation, work shall be performed carefully so as not to cause any damage to adjacent structures and buried structures.

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

(6) Excavation of road, if any, shall be done in such a manner as not to hamper vehicular traffic. If excavation is to be performed in the vicinity of residences, appropriate care shall be taken so as not to hinder the passage of residents.
Spoils, materials and equipment shall be carefully handled.

(7) After completion of excavation, excavated widths and bottoms shall be subject to inspection by the engineer.

(8) Blasting shall not be employed during excavation.

(9) Any and all excess excavation for the convenience of the contractor or over-excavation performed by the contractor for any purpose or reason, except may be ordered in writing by the engineer, and whether or not due to the fault of the contractor, shall be at the expense of the contractor. All such excess excavation and other excavation shall be filed at the expense by the contractor with materials approved by the engineer.

(10) The contractor shall be entitled to request the engineer in writing to change the excavation line as required according to the soil conditions of the foundation following the progress of excavation. In such a case, upon excavation up to the laid excavation line, the contractor shall prepare the detailed design drawing of the said foundation and submit it to the engineer for his approval.

(11) All objectionable materials such as, oil, mud, rock fragments, loose rock, chips, mortar, organic matters and stagnant water, shall be removed from the surface of the foundation.

7.6.3.4 Sheeting

(1) Sheeting shall be of the type that is suitable to the condition of foundation and Ground water and shall have a safe structure.

(2) If sheet piles on retaining piles are to be driven at the piling location in the vicinity of buried structures, where they shall be investigated and confirmed by manual trench excavation etc. prior to piling in order to protect these structures from being damaged when piles are to be pulled out, carefulness shall be taken into account to cause no damage to the buried structures.

7.6.3.5 Banking

Foundation of banking shall be treated as follows:

(1) Any material having a harmful effect on banking shall be removed.
   (a) Where inflow of ground water is expected, it shall be treated so as not to cause inundation.
   (b) In case of sloped ground with unfavorable conditions, such as unsuitable soil, poor drainage, etc, a method, such as excavating the ground into steps in advance in order to increase its stability, shall be planned and reported to the Engineer.

(2) Unless otherwise specified, settlement allowance shall be 3 per cent of the height of the banking and the surface shall be graded evenly within =5 cm.

(3) Materials for banking shall not include any harmful materials, such as fertile soil or pieces so wood.

(4) Materials for banking shall not be of an extremely swelling nature.

(5) Impermeable clay shall not be used for back-filling of a structure which is susceptible to earth pressure.

(6) Banking shall be formed by spreading soil of less than 50 cm in thickness and by sufficiently compacting each layer.

(7) The type of compactor shall be one that is suitable or banding materials.

(8) Materials for banking shall be so treated as to have optimum water content in percent of dry weight.

(9) Rocks shall be spread out evenly so as not to form any void space.

(10) Temporary facilities shall not be buried in banking. If it becomes inevitable to do so, it shall be reported to the engineer and shall be approved by the engineer, upon which appropriate measures shall be taken to prevent any unfavorable effect on the banking.

(11) As a standard, extent of satisfactory compaction shall be as follows :

K75 =1.5 Kg./cm3 or more

Where : K 75 is a coefficient of bearing capacity determined by the plate load test.

When required by the engineer, the contractor shall perform in-sity tests and penetration test to confirm the extent of compaction and the result shall be submitted to the engineer.

(12) Any banking work on rainy day shall be carried to upon approval of the Engineer.

7.6.3.6 Back-Filling

(1) Back filling shall be executed as construction proceeds along with the removal of shoring and other materials at the back filling site.

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

(2) Except those which are specified in the specifications or the drawings, all the materials for back filling shall be in accordance with the clauses of "Banking" 2.5 of these specifications.

(3) If the inflow of water exists at the site of back filling it shall be appropriately treated.

(4) In back filling, the layer of spreading shall be around 50cm or less per lift, and it shall be graded as horizontally as possible, and shall be sufficiently compacted by hydraulic filling or by use of an appropriate compactor such as a rammer.

(5) Extent of compaction shall be such that it will prevent future settlement and such that the designated bearing capacity can be obtained. If necessary, the extent of compaction shall be measured by a cone penetrometer etc. and the record shall be submitted to the engineer.

(6) If there is any surface or buried structure owned by the public or the third party at the site of back filling, care shall be taken so as to cause no harmful effect to them, and the execution of the work shall be carried out following direction by the engineer and in the presence of relevant administrators.

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

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

7.6.3.7 Disposal of Excavated Materials

(1) Spoils produced by excavation shall be piled, graded, sloped or disposed of at the locations specified by the Board or Engineer and it shall be subject to inspection by the engineer.

Spoil, whose disposal areas are not specified by the engineer, shall be disposed of by the contractor at his responsibility.

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

7.6.3.8 Gravel Layer

(1) Gravel and rubble produced locally shall be used. Gravel layer shall, in principle, be laid in a single layer with no large gaps, stand on end and interstices shall be filled with granular gravel.

(2) The compaction shall be executed by a compaction machine (rammers, etc.)

(3) Gravel layer shall be well compacted together with covering gravel and shall be graded and finished to the designated level.

7.6.4 Piling

7.6.4.1 Pile Driving

(1) Piles shall be driven by a pile driver, suitable for the type and size of the piles, geological conditions and construction environment, and in such a manner as to cause no public nuisance, such as noise, to the third party.

(2) The method for construction joint of piles shall be submitted in writing to the engineer and shall be subject for approval by the engineer.

(3) Records shall be kept during the poling operation and these shall be submitted to the engineer.

(4) Piles shall be driven vertically and at the exact locations indicated in the drawings, and pile driving shall be continuous without interruption to avoid deviation of pile head.

(5) Caps and other suitable materials shall be used as a cushion to protect the head of piles.

(6) Toward the end of driving the amount of penetration shall be measured for each pole as directed by the engineer.

(7) Should it be difficult to drive any pile up to the specified depth, the contractor shall carry out such pilling work in accordance with the instructions of the engineer.

(8) Method and equipment of pile driving to be employed for construction works shall be subject to approval of the engineer prior to execution.

(9) When driving a group of piles, driving shall begin from the center and gradually moved outward.

(10) When eccentric error exceeds the allowable values shown in the table below or when a pile is damaged or creaked during piling operation, it shall be reported to the engineer, and the pile shall be replaced or an additional pile shall be driven.

Type of Foundation	Allowance	Remarks
All foundations	10 cm or less	

(11) Upon completion of piling, any void portions inside piles shall be filled back with soil obtained from at site excavation.

7.6.4.2 Field Joining of Piles

(1) Field joining of piles shall be carried out by arc welding.

(2) Welders shall have not less than 6 months continuous experience in welding of pile, and shall be qualified by JIS Z-3801, “Standard Qualification Procedures for welding Technique”, or equivalent BDS.

(3) Are welding rods shall be standard items specified in IETC (International Electro technical Commission) or equivqlent “Covered Electrodes for Mild Steel”, or equivalent.
Welding rods shall be completely dry prior to use.

(4) The welding surface of parent metal shall be carefully cleaned of slag, moisture, dust, rust, oil, paint or other foreign matter.

(5) The root face of steel pipe pile shall be 2mm,

(6) Welding shall be performed carefully by selecting welding current and welding speed which ensure complete penetration of welding rood to avoid cracks in any portion of the weld.

(7) Welding shall not be performed when the parent metal is wet from rainfall or when strong winds are blowing. However, when the portion to be welded in suitable protected, welding may be performed upon approval of the engineer.

(8) If harmful defects or cracks have been found in the weld, the deposited metal shall be carefully chipped off and the affected part shall be re-welded and then inspected by the engineer.

7.6.4.3 Treatment of Pile head

(1) The head of the piles shall be cut to the designated level and shall be embedded into the footing.

(2) The steel pipe piles shall be anchored into the footing by a method specified otherwise.

7.6.4.4 Transportation and Handling

Care shall be taken in transportation ad handling of pole so as to prevent damage to them.

If the pile is damaged or deformed to the extent that it is impractical for the intended use, the contractor shall repair it prior to driving, and it shall be inspected and approved by the engineer.

7.6.5 Reinforced Concrete Work

7.6.5.1 General

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

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

(3) Reinforced concrete work and plain concrete work shall comply with ACI (American Concrete Institute), BNBC (Bangladesh National Building Code) or equivalent standard .

(4) Covering

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

(b) In general, the covering shall be at least those shown in Table-1.

Table-1 : Minimum Covering (mm)

Conditions	Slabs	Beams	Columns
When not directly exposed to rain or wind	20	40	40
Large and important structure, or when exposed to Rain or wind	25	40	65
When effective coating is not applied on the portion Which may be subjected to injurious chemical reaction			
Due to smoke, acid, oil, salts, etc.	37.5	50	75

(c) In case of footings and important members of a structure it is recommended that the covering be at lest 7.5 cm when concrete is placed directly facing the ground, and at least 5 cm for bars with diameter of more than 16cm and 4 cm for bars with the diameter of less than 16 mm when the concrete is buried and directly facing the ground or when it is subjected to severe weather conditions. However, the covering at the bottom side of slabs may be at least 2.5cm even if the portion of it is subjected to extreme weather condition.

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

7.6.5.2 Quality of Concrete

(1) General

Concrete shall have the uniform quality with the required strength, durability, water tightness etc.

(2) Strength

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

(b) Compression tests for concrete shall be performed in accordance with ACI, BNBC or equivalent standard.

7.6.5.3 Materials

Materials used for the construction of buildings shall conform to standard specifications listed in this part of the Code. Any deviation from the type design or architectural detail from those specified in these standards may be accepted by the Building Official as long as the materials standards specified therein are conformed with.

7.6.5.3.1 Cement

Cement for shall be Ordinary Portland Cement complies with the standards listed as follows: BDS 232: 1974, Portland Cement (Ordinary and Rapid Hardening) or ASTM C150, Portland Cement; ASTM C91, Masonry Cement; ASTM C595, Blended Hydraulic Cements.

Cement for other than masonry shall conform to the following standards: BDS 232, Portland Cement (Ordinary and Rapid Hardening); BDS 612, Sulphate Resisting Portland Cement-Type A; ASTM C150, Portland Cement; ASTM C 595, Blended Hydraulic Cements; and to other such cements listed in ACI 318.

7.6.5.3.2 Water

(1) Water shall be free from injurious amounts of oils, acids, salts, organic materials or other materials that may be deterious to concrete.

(2) Sea water shall not be used in mixing concrete for reinforced concrete.

7.6.5.3.3 Fine Aggregate

(1) General

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

Beach sand shall not used for concrete.

(2) Grading

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

Table-2 : Standard Grading of Fine Aggregate

Nominal Size of Sieve (mm)	Weight percentage of those passing a sieve	Nominal size of sieve (mm)	Weight percentage of those passion a sieve
10	100	0.6	25 – 65
5	90 – 100	0.3	10 – 35
2.5	80 – 100	0.15	2 – 10
1.2	50 – 90		

Sieve analysis shall be in accordance with JIS A 1102, or equivalent BD standard.

7.6.5.4 Coarse Aggregate

(1) General

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

(2) Grading

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

Sieve analysis shall be performed in accordance with JIS A 1102, or equivalent BD standard.

Table-3 : Standard Grading of Coarse Aggregate

SS (mm)	Weight percentage of those passing a sieve

SA (mm)		50	40	30	25	20	15	10	5	2.5
			95			40		10	0	
	40	100								
			100			65		30	5	
					95		30		0	0
	25			100						

					100		70		10	5

SS : Nominal Size of Sieve
SA : Size of Aggregate

7.6.5.5 Reinforcement

Reinforcement in masonry shall conform to the standards listed as follows: ASTM A82, Cold Drawn Steel Wire for Concrete Reinforcement; ASTM A615M, Deformed and Plain Billet Steel Bars; ASTM A616M, Rail-Steel Deformed and Plain Bars; ASTM A617M, Axle-Steel Deformed and Plain Bars; ASTM A706M, Low-Alloy Steel Deformed Bars; ASTM A767M, Zinc-Coated (Galvanized) Steel Bars; and ASTM A775M, Epoxy - Coated Reinforcing Steel Bars.

7.6.5.6 Crushed Stones

Crushed Stone to be used as coarse aggregate shall conform to the following standards:
BDS 243 : 1963, Coarse and Fine Aggregates from Natural Sources for Concrete; ASTM C33, Concrete Aggregates; ASTM C330, Lightweight Aggregates for Structural Concrete; ASTM C637, Aggregates for Radiation-Shielding Concrete; ASTM C332 , Lightweight Aggregate for Insulating Concrete; IS: 9142 Artificial Lightweight Aggregates for Concrete Masonry Units.

7.6.5.7 Admixture

Admixtures to be used in concrete shall be subject to prior approval by the Building Official and shall comply with Sec. 2.4.5.1 through 2.4.5.5.

- **Chloride** : Calcium chloride or admixtures containing chloride from admixture ingredients shall not be used in prestressed concrete, concrete containing embedded aluminum in concrete cast against permanent galvanized metal forms, or in concrete exposed to severe or very severe sulphate-containing solutions (see Sec 5.5.2.1 of Part 6).
- **Standards** : Air-entraining admixtures shall conform to ASTM C260. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and retarding admixtures, and water-reducing and accelerating admixtures shall conform to ASTM C494, Chemical Admixtures for Concrete, or ASTM C1017, Chemical Admixtures for Use in Producing Flowing Concrete.
- **Pozzolanas** : Fly ash (Pulverized Fuel Ash) or other pozzolans used as admixtures shall conform to ASTM C618.
- **Blast Furnace Slag** : Ground granulated blast-furnace slag used as an admixture shall conform to ASTM C989.
- **Pigment for Coloured Concrete** : Pigment for integrally coloured concrete shall conform to ASTM C979.

7.6.6 Storage of Materials

7.6.6.1 Storage of Cement

(1) Cement shall be stored separately for each type in either silos or damp-proof warehouses.
(2) Silos to store cement shall be built or equipped with suitable means so that cement will not be retained at the bottom without being conveyed out.

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

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

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

7.6.6.2 Storage of Aggregate

(1) Fine aggregate, coarse aggregate and other aggregate of different type and grading shall be separately stored between each.

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

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

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

7.6.6.3 Storage of Reinforcement

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

7.6.6.4 Storage of Admixture

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

(2) Admixture materials shall be carefully handled so as not to be scattered.

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

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

7.6.7 Testing of Materials

(1) The all materials (cement, water, fine aggregate, coarse aggregate, reinforcement, admixture, etc.) to be used shall be approved by the engineer after the contractor submits the results of tests.

(2) The testing method shall comply with the various codes of ASTM, ACI, BNBC or equivalent standard.

7.6.8 Mix Proportions

7.6.8.1 General

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

(2) Mix proportion for concrete and results of test mixing shall be determined so as to provide the required strength, workability, uniformity and durability. The scheme of mix proportion shall be submitted to the engineer for approval, The attached form of submission shall be used. The design strengths of the concrete shall be the classes indicated below.

4 Fc	=	210 kg/cm2	For Architecture and Switchyard
4 Fc	=	180 kg/cm2	For Transmission
4 Fc	=	120 kg/ cm2	For leveling Concrete

Where 4 Fc means concrete compressive strength at the age of 28 days.

Basic design date for mixing are indicated in the table herein.

Table – 4 : Basic Mix Data

Class	Design strength 4Fc (kg/cm^2)	Maximum size of aggregate(mm)	Slump (cm)	Air entertainment (%)	
E	210	25	10 – 15	4 1	Architecture Switchyard
B	180	40	10 – 15	4 1	Transmission
C	120	40	10 – 15	4 1	Leveling Concrete

Note :

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

2. Relationship between C/W (Cement water ratio) and maximum compressive strength at 28 days.
   ø 28 = 210 + 215 C/W

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					Quantity (per mixed 1 m^3) (kg/m^3)				
Maximum size or	Slum	Air entrain-	Maximum	Sand percen	Water W	Cement C	Fi	Coarse aggrega	Admixtures

aggregate (mm)		ment (%)	water/ cement W/c (%)	-tage S/a (%)				te	
								mm-mm	mm-mm

7.6.9 Batching and Mixing

7.6.9.1 Batching

(1) General

Each material to be used in concrete is obtained.

(2) Batching Equipment

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

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

(3) Batching of materials

(a) Batching shall be made in accordance with the job mix. Test for surface water of the aggregate shall be in accordance with ASTM or equivalent or as directed by the engineer. Test for the quantity of the effective absorption of water, in case of dried effective absorption of water, shall be as directed by the engineer.

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

(c) Each material shall be batched by weight for each batch except the water and the solution of admixture, which may be measured by volume.

(d) Error in the measurement in each batch shall be at most the values given in Table 5.

Table-5 : Allowable Error in Measurements

Type of Materials	Permissible Error (%)
Water	1
Cement &Admixture Material	2
Aggregate	3
Solution of Admixture Agent	3

7.6.9.2 Mixing

All concrete shall be mixed thoroughly until there is a uniform distribution of materials and shall be discharged completely before the mixer is recharged.

Ready mixed concrete shall be mixed and delivered in accordance with the requirements of "Specification for Ready Mixed Concrete" (ASTM C94) or "Specification for Concrete Made by Volumetric Batching and Continuous Mixing" (ASTM C685).

Job mixed concrete shall be mixed in accordance with the following:

a) Mixing shall be done in a batch mixer of approved type.
b) Mixer shall be rotated at a speed recommended by the manufacturer.
c) Mixing shall be continued for at least 90 seconds after all materials are in the drum, unless a shorter time is shown to be satisfactory by the mixing uniformity tests of "Specification for Ready Mixed Concrete" (ASTM C94).
d) Materials handling, batching, and mixing shall conform to the applicable provisions of "Specification for Ready Mixed Concrete" (ASTM C94).
e) A detailed record shall be kept to identify:
    i) number of batches produced;
    ii) proportions of materials used;
    iii) approximate location of final deposit in structure;
    iv) time and date of mixing and placing.

(1) General

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

(2) Mixers

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

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

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

(3) Mixing

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

(b) Mixing time shall, in principle, be determined based on tests. As a standard, it shall be at least 1 minute and 30 seconds for tilting type misers and 1 minute for forced mixers.

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

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

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

(f) Concrete left as mixed and commenced setting shall not be used after re-tempering.

7.6.10 Conveying and Placing

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

(2) Concrete shall be conveyed by methods which will minimize separation and loss of materials, shall be placed immediately and then shall be thoroughly compacted. Even when it is impossible to place the concrete immediately due to some special reasons, the time between mixing and the completion of placing shall not exceed 45 minutes.

During the waiting period, the concrete shall be protected against direct exposure to the sun, wind and rain, and the concrete left for a relatively long time shall be re-mixed without adding my water. No portion of concrete which has started to harden shall be used.

(3) When extreme separation is observed in concrete during its delivery or placement, it shall be made uniform in quality by re-mixing.

7.6.10.1 Conveying

(1) Conveying

Equipment to be used in conveying concrete shall be those which can easily deposit. Should the delivery distance be long, they shall be equipped with such facility as an agitator.

(2) Buckets

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

(3) Belt Conveyors

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

(4) Buggies and Trolleys

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

(5) Chutes

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

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

7.6.10.2 Placing

(1) Preparation

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

(b) Prior to the commencement of the placement, it shall be certified that conveying equipment and placing equipment are in conformance to the plan of placing specified in Clause-_____

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

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

(2) Placing

(a) Concrete shall be placed in accordance with the plan of placing specified in Clause-_____should it be inevitable to change the placing method, it shall be so done as directed by the Engineer.

(b) When concerning is done in hot weather, special attention shall be given to the materials, placement, curing etc.

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

(d) Temperature in concrete at the time of placing shall be at most 35^{o} C.

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

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

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

(h) Concrete shall be embedded into concrete with abundant mortar. Should any notable separation of materials be observed during concerning, the concrete shall be remised to obtain the uniform quality and necessary measures to prevent separation shall be taken before the placing operation is resumed.

(i) Concrete for one section shall be placed continuously until it is completed.

(j) Concrete shall, in principle, be placed in such a manner that the surface of the placed concrete will be horizontal within the section. One lift in placement shall be at most 40 cm, in principle.

(k) Should concrete be placed in layers, each succeeding layer shall be placed while the one below it is still plastic. Should it become necessary to place concrete on top of a layer which has started setting, it shall be done in accordance with Clause 4.10.

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

(m) The height of the end of buckets and hoppers shall be at most 1.5 m above the level of placement.

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

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

7.6.11 Compaction

(1) In principle, internal vibrators shall be used to compact the concrete. When it is difficult to use internal vibrators in the case of thin walls, form vibration shall be used.

(2) Vibrators to be used shall be subject to the approval of the engineer.

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

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

(5) When concerning is to be compacted by internal vibrators, the spacing and the time of their application shall be as directed by the engineer.

7.6.12 Additional Placing

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

(1) Wet Curing.

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

The contractor shall report the said method to the engineer and obtain his approval.

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

(2) Wet Curing

(a) Concrete being placed and compacted shall be protected from the sun, wind, showers etc.

(b) Any exposed surface of concrete which has hardened to a degree that works can be done without impairing it shall be either covered with wet mats, canvas, sand etc. or directly watered, and shall be kept moistened continually for at least 5 days after the placement in case ordinary Portland cement is used.

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

7.6.13 Joints

(1) General

(a) Location and structure of joints as shown and specified in the drawings shall be observed.

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

(2) Construction Joints

(a) Construction joints shall be located where the shear acting there is as small as possible, and with their face in perpendicular, in principle, to the direction of compression in the member.

(b) Should it be unavoidable to make a construction joint at a location where large shear is action, it shall be reinforced by forming tenors or grooves, or embedding suitable steel.

(3) Construction of Horizontal Construction Joints

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

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

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

The concrete shall then be placed immediately and shall be compacted so that is will be in tight contact with the old concrete.

(4) Construction method for Vertical Construction Joints

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

(b) Fresh concrete shall be placed after the surface of the aged concrete at the joint is removed of the surface film or is roughened and thoroughly wetted, followed by the application of cement paste or mortar, or after the surface is treated as directed by the engineer.

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

It is recommended that the new concrete be compacted again after a suitable delay by applying vibration.

7.6.14 Reinforcement Works

7.6.14.1 Processing of Reinforcement

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

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

7.6.14.2 Fabrication of Reinforcement

(1) Prior to fabrication, reinforcement shall be thoroughly cleaned and free from loose rust and any other material which may impair the bond between the reinforcement and the concrete.

(2) Reinforcement shall be placed to the designated position, and shall firmly be fabricated so that it will not be dislocated ruining the placement of concrete. Erection bars, if required, shall be used for this purpose.

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

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

(4) Reinforcement shall be always inspected by the engineer after the completion of fabrication.

7.6.14.3 Joints of Reinforcement

(1) Lap joints of reinforcement shall be made by lapping the required lengths and fastening them together at several points with annealed wire of at least 0.9mm in diameter.

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

7.6.15 Forms and Timbering

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

7.6.15.1 Materials

Materials to be used for the form and the timbering shall be selected based on the strength, rigidity, durability workability, effect on the concrete to be placed.

7.6.15.2 Design of Forms

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

(2) The structure of form shall be such that the corners of concrete can be moulded even when it is not particularly specified.

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

7.6.15.3 Design of Timbering

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

(2) As for the timbering for important structures, design drawings shall be prepared by they shall be subject to the approval of the engineer.

7.6.15.4 Construction of Forms

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

7.6.15.5 Construction of Timbering

(1) Timbering shall be constructed so as to have sufficient strength and stability.

(2) An amount of the settlement of the form words due to the weight of the placed concrete shall be estimated and a chamber shall be introduced, if necessary, in the shoring.

7.6.15.6 Inspection of Forms and Timbering

(1) Forms and timbering shall be inspected by the Engineer prior to the placement of contents.
(2) Condition of forms and timbering shall be inspected during the placement of concrete.

7.6.5.7 Removal of Forms and Timbering

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

(2) Time and sequence of the removal of the removal of the forms and timbering shall be subject to the approval of the engineer.

7.6.15.8 Loading on a Structure Immediately After Removal of Forms and Timbering

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

7.6.16 Finishing

7.6.16.1 General

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

7.6.16.2 Surface Not Facing Sheeting Boards

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

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

7.6.6.3 Surface Facing Sheathing Boards

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

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

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

7.6.17 Quality Control and Inspection

7.6.17.1 General

Materials of concrete, reinforcement, equipment's and workmanship shall be controlled produce reinforced concrete of the required quality economically.

7.6.17.2 Tests of Concrete

(1) During construction, the following tests shall be carried out as directed by the Engineer.
(2) Air test
(3) Compression test of concrete.
(4) Others

7.6.17.3 Inspection of Forms and Timbering

(1) Forms and timbering shall be inspected by the Engineer Prior to the placement of contents.

(2) Condition of forms and timbering shall be inspected during the placement of concrete.

7.6.17.5 Removal of Forms Timbering

(1) Forms and timbering shall not be removed until the concrete reaches a strength required to carry the concrete weight and the load applied during the construction work.
(2) Time and sequence of the removal of the forms and timbering shall be subject to the approval of the Engineer.

7.6.17.5 Loading on All Structure Immediately after Removal of Forms and Timbering

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

7.6.18 Finishing

7.6.18.1 General

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

7.6.18.2 Surface Not Facing Sheathing Boards

(1) Surface of the concrete completed and approximately leveled to the required level and shaper shall not be finished until the water coming out ceases or is removed.

(2) In order to determine the suitability of the curing method and the time to remove the forms, and in order to certify the safety for early loading, strength tests shall be preformed on specimens cured under the conditions as similar as possible to those of the concrete at the site.

Should the result of the test indicate that the obtained strength of the specimen is much smaller than that of the specimens cured under the control condition, the method of curing at the site shall be changed as directed by the Engineer.

(3) For Compression test of concrete, six (6) test specimens shall be required for each concrete. Three (3) specimens shall be tested for seven (7) or fourteen (14) days strength, the remained three(3) specimens shall be tested for twenty- eight (28) days strength.

The expense for the above tests shall be included is the unit prices.

(4) Should it become necessary after the completion of the work, non- destructive test of concrete or tests on concrete specimens cut from the structure shall be carried out.

7.6.18.3 Test of Reinforcement Bars

In the case where there is no test certificate of reinforcement bars (mill sheet) or incase the Engineer deems necessary, the contractor shall carry out the characteristics test of reinforcement bars and obtain an approval of the Engineer.

7.6.18.4 Test Method

Test method shall conform the those specified in ASTM, ACI, BNBC or equivalent, unless directed otherwise by the Engineer.

7.6.18.5 Report

The result of the tests shall be reported to the Engineer without delay.

7.6.18.6 Control of Concrete by Compressive Strength

(1) Control of concrete by compressive strength shall generally be based on 28 days compressive strength. Specimens, in this case, shall be taken in such a manner that they will represent the concrete of the structure.

(2) Test results of compressive strength to be used for the control of concrete shall generally be obtained by averaging the compressive strength specimens taken from the same batch.

(3) Should the quality of concrete be controlled by the test results, it shall be use the control test.

7.6.18.7 Inspection of Quality of Concrete

(1) The contractor shall submit to the Engineer the results of Inspection of Quality of concrete obtained according to the quality control test in the preceding Paragraph 8.16.6 and obtain and approval of the Engineer.

(2) Should it be found in the inspection that the quality of the concrete is not suitable, remedial measures such as modifying the mix proportions, performance tests of equipment's and facilities, improvement of the working method, etc. shall be taken. The concrete placed in the structure shall be checked if it can perform the designated function and the suitable measures, should it become necessary as directed by the Engineer.

7.6.19 Inspection of Structures

Structures shall be inspected after their completion as directed by the engineer.

- **Brick Masonry Work**

Prior to commencing the brick masonry work, the surface of brick shall thoroughly be cleaned and sufficiently moistened in order to ensure smooth adherence of mortar to the brick surface.

7.6.20 Road Work

The Construction work of roads shall be carried out in accordance with the Drawing.

However, demolition and restoration of the public roads (including private roads) shall be carried out according to the specifications designated the official in charge of road management not with standing the provisions described in the specifications and the Drawing.

7.6.20.1 Road Work Inside The Premises

(1) Sub –grade

a) Any excavation and banking work required for sub-grade construction shall be carried out in accordance with the respective provisions in General Provision SECTION-2 : EARTH WORKS.

b) The material required for banking and displacement shall be so placed that the finished thickness of one layer after compaction will become 20 cm or less.

c) The sub-grade surface shall be finished by proof- rolling in order to obtain the contact pressure sufficient to permit smooth traffic of vehicles of 8 tons or over should any defects be detected as a result of proof-rooling, such detective sub-grade surface shall be finished again to the satisfaction of the Engineer.

d) The finished sub-grade surface shall be within + 5 cm of the design elevation.

(2) Sub base Course

(a) The materials to be used for sub base course shall be in accordance with the specification described in the Drawing. The Contractor shall submit a report concerning the quality of materials and the methods of sampling to the Engineer for approval.

(b) The finished surface of sub base course shall be within –10 mm and + 5mm of the design elevation.

(3) Surface Course (Asphalt pavement)

(a) Prior to commencing pavement, the sides of concrete side walk, manhole, etc. shall be cleaned, and molten asphalt, etc. shall be coated over the sides.

(b) The surface to be seal-coated and prime- coated shall be finished into even level, and after perfecting removing any bloc, dust and other foreign matters, such surface shall be cured and dried.

(c) The mixtures shall be spread uniformly, rolled and finished into the specified thickness. Then, the finished surface shall be measured in parallel to the center line of the load by

using a 3 m straight line ruler. In this case, the depth of any concise sections shall not exceed 5 mm.

(d) The Contractor shall submit a report on the materials to be used for pavement of surface course and method therefore to the Engineer to the Engineer for approval.

(4) Inspection

The Contractor shall receive inspection of the Engineer during the course and after completion of sub base course and surface course works.

7.6.20.2 Public Road (Including Private Road)

(1) Demolition of Pavement

Demolition of Pavement for public roads including private roads shall be carried out so carefully as not to cause any hazardous effect upon the surrounding portions of cement, concrete or pavement.

(2) Road Keeping and Restoration

(a) The road keeping shall be of a construction applicable to the prevailing site conditions and so provided as not to cause any danger or trouble against traffic.

(b) The contractor shall submit the drawings for road keeping to the Engineer for approval.

(c) The Contractor shall constantly patrol any spots of road keeping and exert his utmost efforts perform maintenance and repair of such roads in order to eliminate any trouble against smooth traffic.

(d) The Contractor shall carry out maintenance and repair of any pertinent roads so carefully as not to cause any trouble against smooth traffic until the said roads have been restored and taken over to the official in charge of road management.

7.6.21 Drainage Work

(a) The drainage work shall be as described in the Drawing and carried out in accordance with General Provision SECTION-2 : EARTH WORK AND SECTION-3 : REINFORCED CONCRETE WORK.

(b) The water – plumbing facility for drainage shall be of such a construction as not to cause any trouble against the surrounding area and structure. The contractor shall submit the design and execution schedule for the water plumbing work to the Engineer for approval.

7.6.22 Painting Work

7.6.22.1 General

This clause covers all painting applied to surface of plaster wood, and metal indicated in the Drawing. No painting shall be applied to surfaces of stainless steel copper, bronze, brass or any/all steel in contact with concrete. Painting work shall be performed by skilled workmen. Selection of color shall be as determined by the Engineer, unless otherwise specified.

7.6.23 Materials and Painting Coat

7.6.23.1 Materials

Materials to be used in this clause shall be as follows and shall conform PAINTS AND VARNISHES

- **Water Based Paints**

  Water based paints shall conform to the following standards:

BDS 500:1965	Specification for Distemper Dry (under revision);
BDS 1097:1984	Specification for Plastic Emulsion Paint. Part I for Interior Use; Part 2 for Exterior Use;
IS 5410-1969	Specification for Cement Paint, Colour as Required;
IS 428-1969	Specification for Distemper, Oil Emulsion, Colour as Required

- **Ready Mixed Paint and Enamels**

  Ready mixed paints and enamels shall conform to the following standards:

BDS	13:1960 Specification for Ready Mixed Paints, Varnish, Lacquers and Related Products (under revision);
BDS	14:1960 Specification for Black Bituminous Paint, Brushing for General Purposes (under revision);
BDS 397:1964	Specification for Ready Mixed Paint, Brushing, Red Oxide Zinc Chrome, Priming (under revision);
BDS	398:1964 Specification for Ready Mixed Paint, Spraying, Red Oxide Zinc Chrome, Priming (under revision);
BDS 399:1964	Specification for Aluminum Paint, Spraying for General Purposes, in Dual Container (under revision);
BDS	400:1964 Specification for Aluminium Paint, Brushing, for General Purposes in Dual Container (under revision);
BDS	401:1964 Specification for Varnish, Finishing, Exterior, Type-I, (Synthetic) (Tentative) (under revision);
BDS 402:1989	Specification for Ready Mixed Paint, Brushing, Finishing, Semigloss, for General Purposes (First Revision);
BDS 499:1965	Specification for Ready Mixed Paints, Brushing, for Road Marking (white, yellow and black) (under revision);
BDS 616:1966	Specification for Enamel, Brushing, Exterior (i) Undercoating, (ii) Finishing, Colour as Required (under revision);

BDS 617:1966 Specification for Enamel, Brushing, Interior (i) Undercoating, (ii) Finishing, Colour as Required (under revision);

BDS 926:1980 Specification for Ready Mixed Paint, Brushing, Petrol Resisting, Air Drying, for Exterior Painting of Containers, Colour as Required;

BDS 927:1980 Specification for Ready Mixed Paint, Brushing, Petrol Resisting, Air Drying, for Interior Painting of Tanks and Containers, Red Oxide (colour unspecified);

BDS 928:1980 Specification for Ready Mixed Paint, Brushing, Acid Resisting, for Protection Against Acid Fumes, Colour as Required;

BDS 973:1981 Specification for Specification and Methods of Test for Linseed Stand Oil for Paints and Varnishes;

BDS 974:1981 Specification and Methods of Test for Raw Tung Oils for Paints and Varnishes;

BDS 1005:1981 Specification for Ready Mixed Paint, Brushing, Finishing, Stoving, Enamel, Colour as Required;

BDS 1141:1986 Specification for Ready Mixed Aluminium Priming Paints for Woodwork;

BDS 1151:1986 Specification for Pavement Marking Paints.

7.6.24 **Thinners and Solvents**

These shall conform to the following standards:

IS 324-1959 Specification for Ordinary Denatured Spirit (revised);

IS 533-1973 Specification for Gum Spirit of Turpentine (Oil of Turpentine) (First Revision);

IS 82-1973 Methods of Sampling and Test for Thinners and Solvents for Paints (First Revision).

- **Varnishes and Lacquers**

These materials shall conform to the following standards:

BDS 401:1964 Specification for Varnish, Finishing, Exterior, Type-I, (synthetic) (under revision);

BDS 1064:1983 Specification for Varnish, Staving;

BDS 1065:1983 Specification for Varnish, Acid Resisting;

BDS 1066:1983 Specification for Varnish, Finishing, Interior;

IS 197-1969 Methods of sampling and Test for Varnishes and Lacquers (First Revision);

IS 340-1978 Specification for Varnish, Mixing (First Revision);

IS 346-1952 Specification for Varnish, Spirit, Clear, Hard;

IS 347-1975 Specification for Varnish, Shellac for general purposes (First Revision);

IS 348-1968 Specification for French Polish (First Revision);

7.6.23.2 Painting Coat

Number of coats shall be as indicated in the table below.

Number of coats

Material to be painted		Primary	Secondary	Finishing
Steel	Outdoor	2	2	1
	Indoor	2	1	1
Wood	Outdoor	1	2	1
	Indoor	1	1	
Concrete Plaster and board	Outdoor	1	2	1
	Indoor	1	1	1
Acid – proof	Indoor	1	3	1
Galvanized steel	Outdoor	2	1	1
	Indoor	1	1	
Touch –up of galvanized steel		1	1	1

7.4.23.3 Workmanship

(1)Smooth Finished & soft colored Plastic paint should be used over the Plastering work of interior wall and ceiling.

(2)Smooth Finished & Architectural approved colored weather coat should be used over the Plastering work of Exterior wall. Some where should be used Ceramic Facing brick (Strip)/ Rustic Tiles as per direction/decision of Architecture or approved 3D view.

(3) Painting shall be applied by spraying, brushing or rolling.

(4) Surfaces to be painted shall be smooth, dry and free from dirt, loose mill scale, rust, grease, or other deleterious material

(5) The contractor shall submit the samples and catalogue of paint of the Engineer for approval.

7.6.23.4 Protection

Drop clothes shall be furnished and place to fully protect all parts or work during execution of the contract. The Contractor shall be held responsible for paint droppings on cement floor and base.

Paint droppings shall be entirely removed, and damaged surfaces shall be repaired in a manner satisfactory to the Engineer.

No work shall be accepted which shows laps. Stains, flat or glossy spots or imperfections in surface over which paint or other finish is applied.

All rubbish, waste, or surplus materials shall be removed from time to time, and all woodwork, hardware, floors or other adjacent work shall be cleaned.

All glass throughout the building shall have all paint or varnish sports and brush marks removed, and upon completion of the painting work, all glass that is scratched or damaged by the painter's work, shall be replaced at the contractor's responsibility.

Hardware and other unpainted metal surfaces shall be cleaned.

CONTROL BUILDING

7.6.24 Temporary Work, Earth Work and Piling Work

7.6.24.1 General

The work of the above items shall be specified in clauses "TEMPORARY WORK", "EARTH WORK" and "PILING WORK" in Section 1 "GENERAL PROVISIONS", unless otherwise specified.

7.6.24.2 Materials of Pile

The pile to be used for Control Building shall be steel pipe pile (406.4 x 6.4)

7.6.25 Concrete Work

7.6.25.1 General

Concrete work shall be as specified in Clause "CONCRETE WORK" in SECTION 1 "GENERAL PROVISIONS", unless otherwise specified.

7.6.25.2 Classification of Materials to Be Used for Buildings

7.6.25.2.1 Concrete

The classification to be used for structural concrete shall be 4 Fc= 210 kg/cm2 concrete. (class E 210-10-25)

The classification to be used for leveling concrete shall be 4 Fc = 120 kg/ cm2 concrete. (class C 120-10-40)

7.5.25.2.2 Reinforcing Bar

Reinforcement and welding of reinforcement to be placed in concrete shall conform to the requirements of this section.

a) Deformed Reinforcement : Deformed reinforcing bars shall conform to the following standards; BDS 1313, Steel Bars and Wires for Reinforcement of Concrete; BDS 580, Rolled

Deformed Steel Bars (intermediate grade) for Concrete Reinforcement; Reinforcement conforming to the ASTM, Standards: A615M, Deformed and Plain Billet-Steel Bars; A616M, Rail-Steel Deformed and Plain Bars; A617M, Axle-Steel Deformed and Plain Bars; A706M, Low-Alloy Steel Deformed Bars; A767M, Zinc Coated (Galvanized) Steel Bars; and A775M, Epoxy-Coated Reinforcing Steel.

b) Deformed reinforcing bars with a specified yield strength (f_y) exceeding 410 MPa may be used, provided f_y shall be the stress corresponding to a strain of 0.35 per cent and the bars otherwise conform to ASTM standards noted above. Fabricated deformed steel bar mats conforming to ASTM A184M and deformed steel wire complying with ASTM A496 may be used. Deformed wire for concrete reinforcement shall not be smaller than size D4 (Nominal diameter : 5.72 mm), and for wire with a specified yield strength f_y, exceeding 410 MPa f_y shall be the stress corresponding to a strain of 0.35 per cent.

Welded deformed steel wire fabric conforming to ASTM A497 may be used; for a wire with a specified yield strength (f_y) exceeding 410 MPa, f_y shall be the stress corresponding to a strain of 0.35 per cent. Welded intersections shall not be spaced farther apart than 400 mm in direction of calculated stress, except for wire fabric used as stirrups.

7.6.25.2.3 Form

7.6.25.2.3.1 Form Oil

Form oil shall be light colored paraffin oil or other acceptable non-staining material. Form in contact with concrete shall be given a uniform light spray coating of the specified form oil coating in accordance with the manufacturer's recommendations. Form coating shall be applied to the forms before they are set.

7.6.25.2.3.2 Form Ties

Form ties shall have sufficient strength, stiffness and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. The type of form ties used shall be submitted to the Engineer for approval.

7.6.26 Steel Reinforcement

7.6.26.1 Lapped Splices in Reinforcement

Splices at points of great stress shall be avoided wherever possible, and care shall be exercised to avoid concentration of splices at one place.

a) Length of Lap

The lengths of laps in lapped splices shall be in accordance with the Drawings and indicated below.

40 d without hook
35 d with hook

The length of lap in a lapped splice of reinforcing bars of different diameters shall be based on the nominal diameter of smaller bar.

7.6.26.2 Anchorage of Reinforcement

The length of anchorage of reinforcement shall be determined in accordance with the type of reinforcing bar, the grade of concrete and type of stress acting on the reinforcement, and shall be as indicated in the table below, unless otherwise indicated.

Length of Anchorage of Reinforcement

Re-Bar	Strength of Concrete Ordinary Concrete		Length of Anchorage Lower Bar Beam	Floor, Roof
SD30	210kg/mc2	35 d or 25 d with hook	25 d or 15 d with hook	10 d and 15 cm or more

Note : "d" denotes nominal diameter of reinforcing bar.

7.6.26.3 Dowels

Dowels shall be installed at right angles to construction joints. Dowels shall be accurately aligned parallel to the finished surface and shall be rigidly held in place and supported during placing of the concrete.

7.6.26.4 Concrete Protection for Reinforcement

The thickness of concrete cover for reinforcement shall be determined to provide necessary fire resistance, durability and bearing strength of the member. Minimum concrete cover shall be provided in accordance with the table below.

Table : Minimum Thickness of Concrete Cover for Reinforcement

Item	**Structure Element**		**Covering Thickness (cm)**	
	Floor, Wall	Covered finish	2	
		Uncovered	3	
		Interior finish	3	
Part not		Uncovered	3	
Contacting Column, Beam wall Ground		Exterior, covered finish	3	
		Uncovered	4	
	Bearing wall		4	

Table : Minimum Thickness of Concrete Cover for Reinforcement (Cont'd)

Item	Structure Element		Covering Thickness (cm)	
		Wall, Column, beam, floor	4	
Part contacting ground		Foundation, retaining wall	6	

7.6.26.5 Concrete Test

The test of concrete shall be executed as follows :

a) The concrete tests, necessary to maintain the quality control of concrete, shall be executed and their test results shall be submitted to the Engineer.

b) For concrete compressive tests, six (6) test specimens shall be required for each concrete placement.

c) Three (3) specimens shall be tested for seven (7) or fourteen (14) days strength, the remained three(3) specimens shall be test tested for twenty-eight (28) days strength.

d) The test of concrete shall be executed once for each 150m 3 or less of concrete to be poured on the same day.

The expense for the above tests shall be included in the unit prices.

7.6.26.6 Tolerances for Concrete Construction

Concrete structure shall be constructed to the line shown in the drawings.

Any structure which does not conform to such lines within the tolerances listed below shall be repaired, removed and made a new by the contractor.

Tolerances limits of concrete structure shall, as a standard, be in accordance with the table below.

Tolerance Limited

Type	Item		Tolerances against base line (mm)
Column, wall	A. Form	Architecturally formed	3
		Others	5
	B, Concrete surface		7
Beam, slab	A. Form		1
	B. Deflection		3
	C. Concrete surface		7
	A. Column line		3

7.6.26.7 Steel Thrown Finish

After the placing of concrete has been completed, steel trowel finish shall be applied to interior concrete floors, such as bed of vinyl asbestos tile and exposed steel trowel finish floor as indicated in the drawings.

The finished floor surfaces shall be true plane surfaces with no deviation in excess of 3.0mm when tested with a 300mm.
Surfaces shall be pitched to drains where indicated in the drawings.

Instead of hand finishing, the contractors may use an approved power finishing machine provided that the finished surfaces are free of machine marks or ridges.

7.6.26.8 Concrete Surfaces to Be Exposed

Form surfaces that will be in contact shall be of material that is non-reactive with concrete and that will produce concrete surfaces equivalent in smoothness and appearance to that produced by new plywood panels.
Smaller size panels shall be used only where required by openings or joint details, with each area less than 120 cm wide formed with a single panel accurately cut to the required dimensions.

Cut surfaces shall be smooth and treated with form coating. Panel joints that will be in contact with concrete shall be smooth and free of offset.

Form materials with defects that will impair the texture and appearance of finish surfaces shall not be used.

Column forms shall be made with a minimum number of joints.

7.6.27 Masonry Work

7.6.27.1 Concrete Block Masonry

7.6.27.1.1 General

This clause covers walls, partitions and lintels constructed with pre-cast concrete hollow blocks reinforced with steel bars.

7.6.27.1.2 Materials

1) Cements and aggregate

Cement and aggregates to be used in the concrete hollow block shall be as specified in the clause “REINFORCED CONCRETE WORK”. Coarse aggregate for blocks shall not be larger than one-fifth (1/5) of the narrowest with of hollow block section.

2) Cement mortar and concrete

Reinforcing bars shall be as specified in the clause “ REINFORCED CONCRETE WORK”

3) Cement mortar and concrete

Standard mix proportion shall be as follows, unless otherwise shown:

	Work	Mix proportion (by volume) Cement : (slaked lime) : sand
	For masonry Joint	1 : 3
Cement mortar	For Tamping	1 : 3
	For painted joint	1 : 3
Concrete	For Tamping	1 : (2.5) : 3.5

7.6.27.1.3 Working Drawings

Working drawings of the block laying plan including reinforcing for arrangements and the places of anchor bolts shall be submitted to the engineer for approval.

7.6.27.1.4 Application Method

1) Reinforcing Bars

Unless otherwise specified, reinforcing bars shall be of D10, and shall be placed at three (3) block intervals horizontally and two (2) block intervals vertically.

Intersection of the bars shall be securely tied with wire. The extra reinforcing bars to be used for the perimeters of the opening shall be of D 13.

2) Laying

The concrete surface to receive blocks shall be cleaned and thoroughly wetted prior to laying the masonry units. All masonry units shall be clean and free from surface dust before laying, and shall be laid by suing cement mortar.

Fractional parts of units will not be permitted where whole units can be used. Joints shall be 10mm thick, and as uniform as possible.

All exposed joints shall be raked 10mm deep and tooled firmly so as to produce a smooth, tight surface. All cell where reinforcing bars are inserted and blocks are jointed shall be compactly filled with specified mortar (tamping mortar).

Laying of blocks shall not exceed 1.2 meters per day in height.

Pipes and conduits to be inserted in the concrete hollow block walls shall be embedded in such a manner as not to cause any damage to the block. The contractor shall coordinate placing of all items embedded in masonry, and shall be responsible for any changes in positions.

7.6.28 Lintel

Lintels for opening shall be of reinforced concrete and extended to a length of at least 20mm into the adjoining walls.

All cells of the blocks directly below the extended lintels shall be filled with mortar.

7.6.29 Bond Beam

When the height of concrete block wall exceeds 30 times the wall thickness, reinforced pre-cast or pour in place concrete bond beam shall be provided at each 30 times exceeding the wall thickness.

7.6.30 Precast Concrete Block

7.6.30.1 General

Materials, such as cement, aggregate, reinforcing bars, etc. shall be as specified in the Clause "REINFORCED CONCRETE WORK"

Maximum size of coarse aggregate shall be less than 5mm. Specific gravity of coarse aggregate shall be 2.7 or more, unless otherwise specified.

Mix proportion of cement, sand : coarse aggregate shall be 1:2:4, respectively.

7.6.30.2 Lightweight Concrete Block for Roofing

Specific gravity of coarse aggregate for lightweight concrete shall be 1.7.- 1.9.

7.6.31 Water Proofing Work

7.6.31.1 General

This clause covers all waterproofing, built up roofing and mortar waterproof.

7.6.31.1.1 Built Up Roofing

7.6.31.1.2 Materials

(1) Asphalt Primer

Asphalt primer shall be applied by spraying or brushing. The quality of material shall be in accordance with the table below:

Drying Time	Not less than 8 hours
Remainder after drying	Not less than 35%
Specific Gravity	Less than 1.0

Test method for the above shall comply with JIS K 5400 or equivalent BDS

(2) Asphalt Compound

The quality of materials shall conform to ASTM, and shall in accordance with the table below.

	Asphalt Compound

Penetration (25 ^{o}C, 100 gr, 5 sec.)	20 – 30 (2.0 ~ 3.0 mm)
Softening Point ^{o}C	Not less than 90 ^{o}C
Carbon disulfide	Not less than 97%
Matteability (25 ^{o}C)	Not less than 2.5mm
Volume of Evaporation	Less than 0.5%
Penetration after evaporation	Not less that 70%

Flashing Point (open cup method)	Not less than 230 ^{o}C
Specific Gravity	1.01 - 1.04

(3) Asphalt Roofing

Asphalt roofing shall comply with JIS A 6006 (Asphalt Roofing Felts), or equivalent BDS and shall be 45kg. – item (21.0m x 1.0 m per roll)

The Contractor shall submit sample of asphalt roofing to the engineering for approval.

(i) Specific roofing shall, in principle, consist of copper mesh (#38) or glass-fiber (#23) coated with asphalt, and the weight of standard item shall be 55kg.

(ii) Perforated Roofing

Quality of material shall comply with JIS A 6006 or equivalent BDS
The Contractor shall submit the sample to the engineer for approval.

7.6.31.1.3 Grades of Water Proofing

Working Process	Class – A	Class - B
1	Asphalt Primer (0.31/m^2)	Asphalt Primer (0.31/ m^2)
2	Perforated roofing within layer of sand	Asphalt (0.1 kg/ m^2)
3	Asphalt (1.2 kg/ m^2)	Asphalt Roofing
4	Special roofing	Asphalt (1.0 kg/ m^2)
5	Asphalt (1.0 kg/ m^2)	Special roofing
6	Special roofing	Asphalt (1.0 kg/ m^2)
7	Asphalt (1.0 kg/ m^2)	Asphalt roofing
8	Asphalt roofing	
9	Asphalt (2.0 kg/ m^2)	

Class – A shall be applied for the roof.
Class – B shall be applied for the lavatory.

Inclination of the base concrete shall be, in principle, more than 1/100.

7.6.31.1.4 Application Method

Asphalt primer shall be evenly sprayed over the base concrete or roof insulation board. Asphalt compound shall then be vinyl poured and spread over the asphalt primer. Compound heated to a temperature exceeding 230^{o}C shall not be used.

In the case of class – A, perforated roofing shall be laid between asphalt primer and asphalt compound.

Asphalt felt, roofing and special roofing shall be flatly laid over each respective asphalt compound. The sides and ends of these sheets shall be provided with an overlap of at least 9 centimeters. The joints shall be completely water tight and not be concentrated.

Care shall be exercised for the roofing works surrounding anchor bolts, parapets and roof drains to prevent any leakage.

7.6.32 Mortar Waterproofing

The waterproofing agent shall be used for mortar waterproofing of roof and balcony.

Cement and sand to be used for waterproofing mortar shall be as specified in the clause "PLASTER WORK"

The catalogue and mix proportion shall be submitted to the Engineer for approval.

The application method of mortar shall be as specified in the clause "PLASTER WORK"

7.6.32.1 Caulking

7.6.32.2 General

The Contractor shall furnish all materials, labor and equipment necessary to complete the work as specified or as directed by the engineer.

The contractor shall submit the catalogues and work procedures to the engineer for approval.

7.6.32.3 Material

(1) Oil caulking compound shall conform to JIS A 5751 (Oil Based Caulking compounds Buildings) or equivalent.

(2) Thiokol caulking shall conform to JIS A 5754 (Polysulfide Sealing compound for Buildings) or equivalent.

(3) Thiokol caulking shall be used as joint for all surroundings of exterior doors, windows and concrete panels.

7.6.32.4 Workmanship

All joint surfaces to be filled shall be sound, clean and dry. All concrete surfaces shall be fully cured before application of caulking.

Joint surfaces to be filled shall be primed with the manufacturer's recommended primer, compatible with the Thiokol base sealing compound and appropriate for the surfaces to be sealed.

Mixing and application of filling compound shall be in accordance with the manufacturer's recommendations, and shall be submitted to the engineer for approval.

All filler work shall be done by skilled workmen.

7.6.33 Control Joint For Roof

Control joint shall be provided between mortar finish and light weight concrete block and at about 4.0mm of intervals in light weight concrete block area of roof.

Control joint shall consists of elastight and asphalt mortar.

7.6.34 Tile Work

7.6.34.1 General

This clause covers all works required for mosaic tile, ceramic tile and others applied on floors and wall.

Working drawings shall be submitted to the engineer for approval.

Prior to starting work, the contractor shall submit samples of tile to the Engineer for approvals.

7.6.34.2 Materials

7.6.34.2.1 Floor Finish

● To be used 600mmx600mm (24 inch x 24inch) size European standard Mirror Polished Homogeneous tiles for 1st to 6th Floor.

● For Ground/Underground Floor finish to be used as per Transformer based design such as use dry gravels for bottom of the Transformer and Rustic Tiles for walk way or common space.

Materials to be used in the works shall be high quality, high grade and good appearance.

7.6.34.2.2 Ceramic Tile for Interior Wall Finish (GWI) for Bath room's wall

Special color and size of European standard Ceramic Tile with decorative Boarder shall be used in Bath rooms & other necessary interior walls.

Materials to be used in the work shall be high quality, high grade and good appearance.

7.6.34.2.3 Ceramic Tile for Exterior Wall Finish

Ceramic tile for exterior wall finish shall be of 60mm x 227mm, colored, glazed and manufactured by qualified manufacturer as approved by the engineer. (if required)

The color of tile shall be designated by the engineer.

7.6.34.2.4 Setting Materials

(1) Cement, sand to be used for mortar bed shall be as specified in the clause "REINFORCED CONCRETE WORK"

(2) Bedding mortar shall be mixed with one part Portland Cement and three parts sand.

7.6.34.3 Setting

(1) Mosaic Tile

The mortar setting bed shall be floated to a uniform plumb and level surface to bring the finish surface to the required plane.

Thickness of mortar shall be about 10 millimeters.

Mosaic sheets shall be placed in positions on the pure coat and freshly combed into the mortar setting bed with trowel. Sheets shall be tamped firmly into place and made true and even with the finished surface line or plane.

Expansion joints or control joints at 6 meters on center shall continue through the mortar bed and mosaic tile and shall be kept free from mortar and grout. Those shall be filled with an approved caulking compound and shall be as close as possible to the color of the grout mortar. All joints, after removal of the paper, shall be grouted leaving then completely and uniformly filled. At no time shall sand or any abrasive be used that will damage the natural sheen of the mosaic tile. All excess grout and glue shall be removed from the face of the tile leaving the finished surface clean.

(2) Ceramic Tile

Laying of ceramic tile shall comply with the specifications for " Mosaic Tile" for floors, tile lay out work shall begin from the center lines of areas to eliminate use of half tiles.

For walls, tile layout work shall begin from the top of the wall and proceed downward.

Tile shall be soaked in clean water for at least one hour prior to setting and applied to setting beds within five minutes after soaking.

(3) Protection

The contractor shall provide and install barriers or other forms of protection and covering to prevent damages.

(4) Cleaning

Tiles shall be thoroughly cleaned after grouting and painting has sufficiently set. A;; traces of cement or foreign matter shall be removed from tiles. Exposed hardware and plumbing trim shall be covered with baseline during tile setting. Base line shall be removed and metal shall be cleaned and polished.

7.6.34.4 Gun Sprayed Tile

Gun sprayed tile shall be applied on the surface of concrete as indicated in the drawings.

Gun sprayed tile shall conform to JIS A 6910 - C or equivalent.

Sealer shall be applied on the concrete surface so as to prevent moisture from main material and to increase adhesion of main material.

Main material shall consist of white Portland Cement, dolomite plaster and coloring agent. The color shall be designated by the Engineer.

7.6.35 Metal Works

7.6.35.1 General

This clause covers all metal works for flooring, siding, walling, flushing, railings, roofing, raiser, plumbing, and other pertinent fixtures. The contractor shall submit fabrication and installation drawings to the engineer for approval.

7.6.35.2 Handrails

7.6.35.2.1 Steel Railings

For Stair case railing to be used Stainless Steel Pipe, Square Box & other decorative post as per drawing to the engineer for approval.
Steel railings, including pipe inserts to be embedded in concrete shall conform to JIS G 3452 and shall be galvanized, unless otherwise specified.

Square pipe shall be of the size indicated in the Drawings.

Galvanizing coat damaged by bolting, welding and other field works shall be repaired and painted with two coats of silver zinc paint.

7.6.35.2.2 Fabrication

Mitered and welded joints shall be made by fitting post to top rail and intermediate rail to post mitering comers, groove welding joints, and grinding smooth.
Railings may be bent at comers instead of jointed, provided that the bends are made in suitable jigs and that the pipe is not crushed or damage.
Edge of the railings shall be covered with steel plates.

7.6.35.2.3 Installation

Rails shall be installed by means of steel sleeve inserts which shall be seat and anchored in the concrete.

Ports shall be inserted into the galvanized steel sleeves embedded in concrete or shall be welded to the stringer, beam or toe plate made level, perpendicular and aligned.

The space between pipe posts and pips sleeve inserts except those marked " Removable handrail" as indicated in the drawings shall be filled solid with molten lead or shall be welded.

7.6.35.3 Steel Ladders

Materials to be used for steel ladders shall conform to JIS G 3101 – SS 41 or equivalent.

Steel ladders shall be fabricated of l- 65 x 6 steel angle stringers and 19mm diameter steel bar rungs. Rungs shall be spaced 350mm apart and shall be inserted into the stringers and welded thereto.

The ladders, including welded on bracket, shall be pointed.

7.6.35.4 Corner Guards

Comer guards for jamps, where directed by the engineer and sills of opening and edges of concrete column and wall shall be of steel angles or steel plates, conforming to JIS G 3101-SS 41 or equivalent, anchored into concrete with welded steel straps or end weld stud anchors.

7.6.35.5 Stair Safety Nosing for Concrete Stair

Stair safety nosing shall be of extruded bronze or stainless steel with cross hatched nosing.

Safety nosing shall be provided with integrally cast or bent anchors for embedding into concrete.

7.5.35.6 Divider Strips

Divider strips shall be half hard brass and shall be placed between different types of floorings as indicated. Divider strips shall be secured to floors by strip anchors or by flat head countersunk brass screws set in lead plugs.

7.6.35.7 Roof Drain

Roof drains shall be of cast iron baked with refined tar and shall conform to JIS A 5511, or equivalent, The size shall be in accordance with the drawings.

7.6.35.8 Corner Bead

Corner bead shall be half hard brass, and shall be placed at edges of columns and wall where mortar or plaster is applied.

7.6.35.9 Blind Box

Blind boxes shall be provided above all windows faced to outdoor, excepting for lavatory, storage, janitorial, kitchen and rooms which located on the first floor.

They shall be constructed of 1.6mm thick steel plate conforming to JIS G 3131, JIS G 3141 or equivalent and shall be painted.

Hanger bracket for installation of the blind box shall be galvanized 6mm thickness flat bar conforming to JIS G 3101 SS 41 and shall be installed at spacing of 90cm diameter expansion blots.

Connection between blind box and hanger bracket shall be 6mm diameter bolts and nuts.

7.6.35.10 Doorsill

Prior to commencement of floor finish work, doorsill shall be provided in place between different types of flooring, unless other wise indicated, and shall be stainless steel conforming to JIS G 4305 – SUS 304 or equivalent.

7.6.35.11 Flashing Plate

Flashing Plates shall be of 2.3mm galvanized steel plate conforming to JIS G 3131, G 2341 or equivalent.

Flashing plates shall be provided at wall and roof opening for piping and at surrounding areas of windows, louvers rolling doors and doors facing outdoors.

7.6.35.1 2 Embedded Plate, Hook and Sleeve

The contractor shall provide plates, hooks and sleeves to be embedded in concrete as required.

Embedded plates, hooks and sleeves shall have sufficient thickness, diameter and anchorage in order to fix equipment, piping and other necessary items. Painting shall be applied on the plates and hooks after fixing the equipment and piping.

The materials to be used for plates, hooks and sleeves shall conform to JIS G 3101 SS 41 or equivalent.

7.6.35.13 Joiner

Joiners shall be provided at surrounding space of suspended ceilings and shall be of aluminum conforming to JIS H 4000 or equivalent.

Small screws shall be of stainless steel or of high strength aluminum alloy.

7.6.35.14 Down Spout

Downspouts to be used for drains shall be steel pipe conforming to JIS G 3442 or equivalent.

Metal bracket shall be of 50mm x 4.5mm steel plate conforming to JIS G 3101 SS 41 or equivalent and galvanized.

Downspouts shall be fixed with metal brackets at maximum of 2.0m per space.

7.6.36 Plaster Work

7.6.36.1 General

7.6.36.1.1 Treatment of Bed

(1) Concrete surfaces which are too smooth to receive plastering shall be roughened before hand with chisels.

(2) Where wall and floors of concrete, concrete block, etc. are distorted or uneven, the bed shall be repaired with mortar.

7.6.36.1.2 Cleaning and Wetting of Bed

The bed, scratch coat, and treated surface of bed shall be cleaned and suitably wetted before application of the following coat.

Portions of the base or coated surface which are not bonded shall be immediately repaired.

7.6.36.1.3 Curing

In order to prevent soiling and premature drying of plastered surface, window and door work shall be completed prior to commencement of the plaster work sheet coverings provided and sprinkling of water performed.

In order to prevent the soiling of neighboring members and other finished surface, suitable protection shall be provided using paper, boarding, tarpauling sheet or other suitable means.

7.6.37 Mortar Plastering

7.6.37.1 Materials

(1) Cement shall conform to JIS R 5210 ordinary Portland Cement or locally produced equivalent.

(2) Sand shall be of good quality free of salts, mud, trash and /or organic matters. The gradation shall be in accordance with the table below.

Table Gradation of Sand

Gradation (by weight)	Type of Mortar Plastering
Passing 5mm sieve……..100%	First coat ad second coat
Passing 0.15mm sieve ……not more than 10%	
Passing 2.5mm sieve……100%	Finish coat
Passing 0.15mm sieve……..not more than 10%	

Water shall be clean and free of sales, iron, sulfur and/ or organic matter, as specified in he clause " CONCRETE WORK".

7.6.37.2 Mixing

The mix proportions of mortar shall be of standard type in accordance with the table below.

Table Mix Proportion (by Volume)

Base	Portion to be Plastered	First Coat	Second Coat	Finish Coat	
		C : S	C : S	C : S	Slaked Lime
	Floor			1 : 2	
	Interior Wall	1 : 2	1 : 3	1 : 3 : 0.3	
Concrete	Ceiling	1 : 2		1 : 3 : 0.3	
Concrete Block	Exterior Wall and others	1 : 2	1 : 3	1 : 3	
Wire lath	Interior Wall	1 : 3	1 : 3	1 : 3 : 0.3	
Metal Lath	Ceiling	1 : 2	1 : 3	1 : 3 : 0.3	
	Exterior wall and others	1 : 3	1 : 3	1 : 3	

In the above table, abbreviated C and S mean cement and sand, respectively.

7.6.37.3 Plastering Thickness

The thickness of application shall be in accordance with the standards indicated in the table below.

Table Plastering Thickness

		Plastering Thickness (mm)				
Bed	Portion to be plastered	First coat	Dubbing Coat	Second Coat	Finish Coat	Total
	Floor	-	-	-	30	30
Concrete	Interior wall	6	5	6	3	20
Concrete Block	Exterior wall	6	7	6	6	25
	Ceiling, others	4.5	-	4.5	3	12
	Interior wall	7.5	-	7.5	3	18
Wire Lath	Exterior wall	6	-	7.5	3	18
Metal Lath	Ceiling, waves	4.5	-	4.5	3	12

7.6.37.5 Application Method

(1) First Coat and Dubbing Out

Mortar shall be trawled on adequately to leave on conspicuous hollow. The surface of the first coat shall be roughened with tools such as metal combs.

The first coat shall be left standing for not less then 10 days allowing cracks to be fully developed before applying the next coat.

Dubbing out for concrete and concrete block shall be performed by roughening with tools such as metal combs and shall be left standing for not less then 5 days.

(2) Second Coat

For the second coat, a ruler shall be provided at external corners, internal corners and edges applied on order to attain an even finish.

(3) Finish Coat

The finish coat shall be applied in a manner so as to be blemish free by watching the degree of drying of the brown coat and by paying special attention to the surface, angles and edges.

The finish shall be either steel toweled, wood troweled or brushed as directed by the engineer.

For the exterior wall, the mortar shall first be troweled on with a wood travel, then furnished with a steel trowel and finally brushed avoiding use of water as much as possible.

(4) Floor Mortaring

In the case of concrete which is several days old, concrete paste shall be buttered on in adequate quantity and spread out with brooms and the like after which application of mortar shall be started.

Application of mortar shall be performed using stiff mortar containing a minimum of water and the mortar shall be tamped to bring moisture to the surface. The mortar shall be screened while paying attention to the grade upon and then shall be troweled smooth.

The crack control joint should be provided at intervals of approximately 3.0m. The joints shall be tooled.

(5) **Base for Tile Fixing**

In the case of using adhesives of wall tile or mosaic tile, mortar application shall be to the second coat.

7.6.38 Plastering

7.6.38.1 Materials

Plaster shall comply with JIS A6904 (Gypsum Plaster) or equivalent. Cement which is more than six (6) months aged shall not be used.

7.6.38.2 Mix Proportion

The mix proportions shall be as follows :

		Plaster				Applied Thickness	
Bed	Layer	For Finish	For Bed	Sand	White Fiber (g)/25kg	Ceiling	Wall
Concrete and concrete block	2nd coat	-	1	2.0	250	6.0	7.5
	Finish coat	1	-	-	-	1.5	1.5

7.6.38.3 Application Method

The surface to receive gypsum plastering shall be leveled with a coat of cement mortar of which the mix proportion of cement and sand is 1:2 prior to the application of plaster and the leveled surface shall be scratched to insure satisfactory adhesion of the plaster.

Before applying plaster, the receiving surface shall be pre pared by removing all foreign substances and shall be dampened.

7.6.39 Doors, Windows and Louvers

7.6.39.1 Wooden Doors and Frames

7.6.39.1.1 General

This clause covers wooden doors and wooden frames, including finish hardware, such as butts, hinges, locks, knobs, stops, strikes, holders, door chains and closures.

7.6.39.1.2 Materials

All doors shall be flush type, of sizes as shown in the drawings. Materials shall be, in principle, locally principle, locally produced. Standard flush doors be double paneled door of 6mm thick plywood and shall have stiffening ribs spaced at intervals of 15cm. Plywood shall be bended to the frames with a suitable adhesives which shall conform JIS K 6801 and 6803 or equivalent.

Waterproofed plywood shall be used for wooden doors for the lavatory.

The waterproofed plywood shall be of 6mm thickness five (5) play and the weight shall be 4.79 kg/m^2.

The each layer shall be completely pressed and adhered by using phonetic resin adhesives and the plywood shall be passed a boiling test and a dry and wet repeating test.

All wooden doors and frames shall be painted as specified in clause “PAINTING” unless otherwise specified.

7.6.39.1.3 Shop Drawings

The contractor shall submit stop drawings of fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installation, sizes, operation, methods of anchoring and any other pertinent details required for the installation thereof.

7.6.39.1.4 Wooden Door Frames

All frames shall be accurately set, plumb, level and shall be securely nailed to the wooden blocks embedded in the concrete or mortar.
Door Frame and Shutter should be made by solid wood such as Burma Teak as per direction/decision of the employer

7.6.39.1.5 Installation

Each door shall be accurately cut, trimmed and fitted to its frame and hardware with allowance for paint finish and possible swelling or shrinkage.
The clearance at the top shall not exceed 6mm.

7.6.39.1.6 Hardware for Wooden Doors

Hardware for wooden doors shall in principle be stainless steel conforming to The applicable standards are listed below :

BDS 113:1986	Specification for Latches and Locks for Doors in Buildings;
IS 204-78	Specification for Tower Bolts; Part I Ferrous Metals (Fourth Revision); Part II Nonferrous metals (Fourth Revision);
IS 205-1978	Specification for Nonferrous Metal Butt Hinges (Third Revision);
IS 206-1981	Specification for Tee and Strap Hinges (Third Revision);
IS 208-1979	Specification for Door Handles (Third Revision);
IS 281-1973	Specification for Mild Steel Sliding Door Bolts for Use with Padlock (Second Revision);
IS 362-1982	Specification for Parliament Hinges (Fourth Revision);
IS 363-1976	Specification for Hasps and Staples (Third Revision);
IS 364-1970	Specification for Fanlight Catch (Second Revision);
IS 452-1973	Specification for Door Springs, Rat-tail Type (Second Revision);
IS 453-1973	Specification for Double Acting Spring Hinges (Second Revision);
IS 729-1979	Specification for Drawer Locks, Cupboard Locks and Box Locks (Third Revision);
IS 1019-1974	Specification for Rim Latches (Second Revision);
IS 1341-1981	Specification for Steel Butt Hinges (Fourth Revision);
IS 1823-1980	Specification for Floor Door Stoppers (Third Revision);
IS 1837-1966	Specification for Fanlight Pivots (First Revision);
IS 2209-1976	Specification for Mortice Locks (vertical type) (Third Revision);
IS 2681-1979	Specification for Nonferrous Metal Sliding Door Bolts for Use with Padlocks (Second Revision);
IS 3564-1975	Specification for Door Closers (hydraulically regulated) (Second Revision);
IS 3818-1971	Specification for Continuous (piano) Hinges (First Revision);
IS 3828-1966	Specification for Ventilator Chains;
IS 3843-1966	Specification for Steel Backflap Hinges;
IS 3847-1966	Specification for Mortice Night Latches;
IS 4621-1975	Specification for Indicating Bolts for use in Public Baths and Lavatories (First Revision);
IS 4948-1974	Specification for Welded Steel Wire Fabric for General Use (First Revision);
IS 4992-1975	Specification for Door Handles for Mortice Locks (vertical type) (First Revision);
IS 5187-1972	Specification for Flush Bolts (First Revision);
IS 5899-1970	Specification for Bathroom Latches;
IS 5930-1970	Specification for Mortice Latch (vertical type);
IS 6315-1971	Specification for Floor Springs (hydraulically regulated) for Heavy Doors;
IS 6318-1971	Specification for Plastic Window Stays and Fasteners;
IS 6343-1982	Specification for Door Closers (pneumatically regulated) for Light Doors Weighing up to 40 kg (First Revision);
IS 6602-1972	Specification for Ventilator Poles;

IS 6607-1972	Specification for Rebated Mortice Locks (vertical type);
IS 7196-1974	Specification for Hold Fast;
IS 7197-1974	Specification for Double Action Floor Springs (without oil check) for Heavy Doors;
IS 7534-1974	Specification for Mild Steel Locking Bolts with Holes for Padlocks;
IS 7540-1974	Specification for Mortice Dead Locks;
IS 8756-1978	Specification for Ball Catches for use in Wooden Almirah;
IS 8760-1978	Specification for Mortice Sliding Door Locks, with Lever Mechanism;
IS 9106-1979	Specification for Rising Butt Hinges;
IS 9131-1979	Specification for Rim Locks;
IS 9460-1980	Specification Flush Drop Handle for Drawer;
IS 9899-1981	Specification for Hat, Coat and Wardrobe Hooks;
IS 10019-1981	Specification for Steel Window Stays and Fasteners;
IS 10090-1982	Specification for Numericals;
IS 10342-1982	Specification for Curtain Rail System

or equivalent.

7.6.40 Steel Fittings

7.6.40.1 General

This clause covers steel fittings, including finish hardware, such as butts, hinges, locks, knobs, stops, strikes, holders, door chains and closures.

7.6.40.2 Materials

Steel sheet shall conform to JIS G 3131, G 3141 or equivalent.

The thickness of steel plates shall be as designated below, unless otherwise specified.

Door Frame		1.6 mm
	Architrave	1.2 mm
	Threshold	2.3 mm
Door Leaf	Frame and flush plate	1.6 mm
	Stiffener and anchor plate	2.3 mm

Machine screws and rivets shall conform to JIS B 1101-1106, JIS B 1201-1205 and JIS B 1131-1133 or equivalent.

7.6.40.3 Steel Doors

Steel doors shall be single or double hollow core, single or double swig type or sliding type and with dimension and location as indicated in the drawings. All doors shall be complete with door frames, hard wares and any / all necessary accessories.

Shop fabricated frames without threshold shall be provided with temporary spreads at bottom to preserve proper shape during transportation and erection.

All metal surfaces shall be thoroughly cleaned and given two costs or rust inhibitive paint after being zinc plated in shop.

Field paint for finish shall be provided as specified in the clause " PAINTING"

7.6.40.4 Steel Louver

Steel louvers shall be of 45^{o} slits and 100mm thick louvers and frame assembly.

The sizes shall be indicated in the drawings.

7.6.40.5 Shop Drawings

The Contractor shall submit shop drawings of fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installations, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation.

7.6.40.6 Installation

All frames shall be erected plumb, square and true to line and level, with secure fattening to structures and anchors.

Doorframes shall be installed by authorized representatives of the manufacturer, but before all plastering works are completed.

7.6.41 Aluminum Fitting

7.6.41.1 General

This clause covers all types of aluminum door, window, casements, and swing, sliding, pivoted, projected, fired and combination doors and windows, including operation hardware.

7.6.41.2 Materials

Extruded aluminum shape and sheet shall conform to JIS H 4100 and H 4000 respectively or equivalent.

Reinforcing strips, reinforcing struts anchors, etc. shall be of zinc plated steel plate conform G 310-SS41.

Small screws shall be of stainless steel conforming to JIS G 5121 SUS 304or of high strength aluminum alloy conforming to JIS H 4040 or equivalent.

7.6.41.3 Shop Drawings

The Contractor shall submit shop drawings of fabricated items to the engineer for approval.

The shop drawings shall clearly show the details of fabrication, installation, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation.

7.6.41.4 Installation

All aluminum windows shall be installed by the manufacturer or his authorized representative and shall be set plumb, square, level and true to line.

Frames shall be set and securely anchored to the structure.

Aluminum surface in contact or other masonry materials shall be provided one heavy brush coat of bituminous paint. Upon completion of the work the contractor shall remove and clean all surplus materials from these areas.

7.6.42 Glass And Glazing

7.6.42.1 General

The contractor shall furnish and install all glass required in doors and windows in accordance with the drawings and any direction of the engineer.
The applicable standards for glass and glazing are listed below :

ASTM C1036-90	Specification for Flat Glass;
ASTM C1044-90	Specification of Heat-Treated Flast Glass Kind HS, Kind FT Coated and Uncoated Glass;
ANSI Z 97.1	Safety Performance Specifications and Methods of Tests for Transport Safety Glazing Materials Used in Building;
CPSC 16 CFR	Safety Standard for Architectural Glazing Materials.

7.6.42.2 Materials

(1) Ordinary sheet glass shall conform to JIS R 3201 (Sheet Glass) or equivalent.

(2) Polished plate glass shall conform to JIS R 3202 (Polished plate Glass) or equivalent.

(3) Figured glass shall conform to JIS R 3203 (Figured Glass) or equivalent.

(4) Wired glass shall meet conform to JIS R 3204 (Wired Glass) or equivalent.

(5) Laminated glass shall conform to JIS R 3205 (Laminated Glass) or equivalent.

(6) Tempered glass shall conform to JIS R 3026 (Tempered Glass) or equivalent.

(7) Multiple glass shall conform to JIS R 3209 (Multiple Glass) or equivalent.

(8) Putty shall conform to JIS A 5752 (Putty for Metal Sash Glazing) and JIS A 5753 (Putty for wooden Fittings).

Putty for steel fittings, the quality shall be class 1, for aluminum fittings, class 2 as specified in JIS A 5752.

(9) The thickness of sheet glass and polished plate glass shall be 3.0mm for figured glass 4.0mm and for wired glass 6.8mm unless other wise specified in the drawings.

7.6.42.3 Workmanship

No glazing work shall be carried out during rain or when the frames or glass is wet.

Frames shall be thoroughly cleaned before application of glazing compound.

All glass in windows and doors, except wooden doors, shall be set in full beds of glazing compound and pressed to a firm and even bearing without springing or forcing. Glass in windows shall be held firmly in place with snap type glazing beads and in doors with glazing channels or beads. Upon completion of construction work, all dirt, stains and mis-applied glazing compound shall be removed, and all glass shall be thoroughly cleaned on both faces.

7.6.43 Painting Work

7.6.43.1 General

Painting work shall be specified in clause “PAINTING WORK” in SECTION 1 “GENERAL PROVISIONS”, unless otherwise specified.

7.6.44 Interior Finish Work

7.6.44.1 General

This clause covers the performance of all works in connection with the following.

1) Vinyl asbestos tile
2) Acid proof vinyl tile
3) Vinyl base
4) Asbestos cement board
5) Acoustic board
6) Suspended ceiling
7) Ceiling Access
8) Insulation
9) Nameplate for rooms
10) Accordion partition
11) Toilet Partition

Prior to starting work, samples of interior finish materials and shop drawings shall be submitted to the engineer for approval.

Types and sizes of nails, screws, bolts and quality of adhesives for fixing of interior finish shall correspond and match to characteristics of the interior finish materials and shall be submitted to the engineer for approval.

7.6.44.2 Fixing

Fixing shall not commence until after drying and cleaning of the base.

Fixing method of specified materials shall be in accordance with the manufacturer's specification and shall be submitted to the engineer for approval.

In performing fixing, adequate precautions shall be provided to avoid off set, gap and/or unevenness.

Suitable protection measures shall be provided on the interior finish until all finishing works are completed.

7.6.44.3 Vinyl Asbestos Tile For Floor Finish

Sizes of vinyl asbestos tile shall be 300mm x 300mm x 3mm thick conforming to JIS A 5705 or equivalent.

- The tiles shall be resistant to alkali, grease or oils.

- The vinyl tiles shall be bonded with asphalt adhesives.

7.6.44.4 Acid-Proof Vinyl Tile

The tiles shall be of acid proof type vinyl tile. The shape and dimensions shall be the same as those of vinyl asbestos tile.

7.6.44.5 Vinyl Base

Vinyl base shall conform to the manufacturer's recommendation of vinyl asbestos tile for flooring unless otherwise indicated, the height of the base shall be 100mm.

7.6.44.6 Asbestos Cement Board

Materials shall conform to " Flexible Board" in JIS A 5403 (Asbestos Cement Sheets) or equivalent.

When necessary, chamfering shall be carried out so as to facilitate the making of joints and prevent their irregularity.

Hardware fixings shall be countersunk screws of stainless steel.

7.6.44.7 Acoustic Board For Ceiling

(1) The material shall be of incombustible rock wool and perforated . The thickness of board shall be 12mm.

Acoustic boards shall be fixed on the base board with suitable adhesives or nails so as to facilitate the making of joints and prevent their irregularity.

(2) Base Board for Ceiling

Base Board shall be plaster boards conforming to JIS A 6901 (Gypsum Board) Grade 2 or equivalent.

The thickness of board shall be 9mm.

7.6.44.8 Suspended Ceiling

The Contractor shall provide a light weight suspension system.

The system shall have the means to properly support the entire ceiling when it is in place.

7.6.44.8.1 Main Runner

Main runners for all suspension system, unless otherwise specified, shall be of cold rolled zinc bonded light channel steel (-38mm x 15mm x 1.6mm) conforming to JIS G 3350.

The channel runner shall be installed 90cm on centers and suspended by steel bars of 6mm dia. Hangers with level adjustable nuts at 90cm intervals.

The grid shall be leveled to within 1/500.

7.6.44.8.2 Cross Furring

Cross furring for ceiling shall be of cold rolled zinc bonded steel (M-23-mm x23mm).

The M-furring shall be installed 30cm on centers and at right angles to the main runner by wire clips. All M-furring shall be straight in alignment and hold so as to enable level placement of plaster board on the suspension system.

7.6.44.8.3 Workmanship

The installation and workmanship shall be in strict accordance with the manufacturer's specifications and shall be made by skilled workmen.

7.6.44.8.4 Insulation

The contractor shall provide insulation boards under the roof slab.

The insulation boards shall be of 25mm thickness cemented excelsior boards conforming to JIS A 5404 or equivalent.

The insulation boards shall be fixed to forms of slab concrete by using nail.

7.6.44.9 Ceiling Access

Ceiling accesses shall be located at suitable places for maintenance of the lighting system and air conditioning ducts and shall be the size of 600m x 600mm.

The materials of the frame for reinforcement of access board shall be made of the same materials as the ceiling, shall be of aluminum conforming to JIS G 4100.

7.6.44.10 Nameplate For Rooms

Name plates shall be provided on all doors of rooms facing out doors, corridors and other rooms.

The size, materials and name on the plates shall be designated by the engineer.

7.6.44.11 Accordion Partition

Accordion partition shall be provided as indicated in the drawings.

Accordion partition shall be of vinyl chloride leather, runner, hinge plate (JIS G 3141 Spec. 1.2mm galvanized), wire rods (JIS G 3505 or equivalent) hanger rail (JIS H 4100-6063, T5 or equivalent) frames, (HIS H 4100-6063, T5 or equivalent) magnet, cushion rubbers and frame holder weight of partition $1m^2$ shall be 7 Kg or less.

Panel shall be of plastic laminated board or steel and paper honeycomb.

Doors shall be of the same materials as panels and door frames shall be of Aluminum Alloy Extruded shapes.

7.6.44.12 Toilet Partitions

In Case of common toilet:

Melamine coated plywood toilet partitions shall be furnished and installed at the locations indicated in the drawings and as described herein.

Toilet partitions shall supported by stainless standing supporters anchored into the floor and y head connection (galvanized square tubing).

Partitions shall be flush type, consisting of two sheets of waterproof plywood. The plywood shall be coated with melamine. All partitions and screen shall be erected plumb, level and in perfect alignment, with hardware fully equipped for proper operation.

7.6.45 Sodding And Planting

7.6.45.1 Sodding

7.6.45.1.1 General

The Contractor shall furnish all work including labor equipment, materials, construction, etc., in connection with sodding work.

7.6.45.1.2 Top Soil with Fertilizer

Stones, leaves, pieces of wood and all foreign matter shall be cleared away before placement of the top soil.

Top soil shall be approved by the engineer. The soil shall be hauled and placed when it is sufficiently dry for spreading.

Manure fertilizer shall be well rotted, unleashed, and free from sawdust, shaving, refuse and / or harmful chemicals.

All manure delivered shall be free from any degree of fly manifestation. All manure fertilizer shall be spread and mixed with the top soil within 48 hours after arrival on the site. Fly breeding prevention shall be by the use of insecticides and / or larvaecides as approved by the engineer.

Areas to be sodded shall be prepared by placing top soil in the areas to the required thickness.

The central part of such areas shall be made higher in comparison to the surroundings to ensure proper drained.

7.6.45.1.3 Sod Planting

Sod planting shall be carried out where indicated in the drawings. Sod shall be planted in firm contact with the bed, and planting work shall be carried out by skilled workmen.

Density of sod planting shall be 70% or more of the area. After fixing the sheets of turf, sandy soil shall be spread at the rate of 0.01-0.02m3 per square meter by using a sieve.

7.6.45.1.4 Leveling of Ground

Before planting the sod, the contractor shall remove all foreign matter, such as weeds, stones and pieces of wood and level the ground. The cost of the leveling of the ground shall be included in the price of the grass planting.

7.6.45.1.5 Watering

Watering equipment of the type which prevents damage to finished surfaces shall be used.

Should the sod become dry, it shall be watered so as to wet the transplanted sod through to t he bottom and through to at least 5cm of the sod bed as well.

Additional watering shall be made as directed by the engineer.

7.6.45.1.6 Protection

Protection of seeded beds against traffic, human or otherwise, shall be provided by erecting barricades immediately after work is completed and by placing warring signs, markers etc. as directed by the engineer.

7.6.45.1.7 Maintenance

Sodden areas shall be maintained (watering, cutting, etc.) by the contractor until taking over.

7.6.45.1.8 Clean Up

After the turning operation has been completed, the surface shall be cleared of all tones larger than 2cm in diameter and of all roots, brush, trash or other matter that may interfere with maintenance operations.

Any paved area over which hauling operation is conducted shall be kept clean and any top soil or other materials which may lie upon the paved surface shall be promptly removed.

7.6.45.2 Planting

7.6.45.2.1 General

The Contractor shall furnish all work including labor, equipment, materials, construction etc. in connection with planting work.

The Contractor shall submit colored pictures of all varieties of trees and flowers to be planted to the engineer for approval.

7.6.45.2.2 Planting Concept

The number of plantings and specie of trees and shrubbery shall be as follows.

Trees	:	25 trees
Shuddery	:	$38m^2$
Notes	:	Tree……around 4.0m

Shrubbery……less than 1.0m

Trees shall be planted so as to provide suitable shade.

The contractor shall survey the soil condition of the site for planting of the trees and shrubbery stated above and shall then carry in soil suitable for the said plants.

7.6.45.2.3 Workmanship

Before plants are carried to the site, the contractor shall prune one-fifth of the trees leaf areas but shall retain the natural form. Spray shall not cause wilting of the leaves. Planting details are shown in the next sheets.

Ground Line to be the
Same as at the nursery

Drawings

Surveyor's Flagging Tape (white)

Fixing wire

Spread 120^{o} Apart

50 x 100 x 900 Stake

Construct Earth Saucer with
100mm high

Backfill with Fertilizer

SHRUB PLANTING DETAILS

7.6.46 Plumbing Equipment Work

7.6.46.1 General

This clause covers the performance of all water supply, sewage and sanitary equipment works to be executed according to the drawings and these specifications.

(1) Water Supply Equipment
(2) Sewage and Air Vent Equipment
(3) Sanitary Equipment
(4) Clarification Tank Equipment

The contractor shall submit shop drawings of the fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installations, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation and the contractor shall submit the result of tests at designated date specified here-in-after.

The contractor shall provide the spare parts for three years normal operation, unless otherwise specified.

7.6.46.2 Equipment and Material

The equipment, materials and accessories as specified herein shall be furnished together with spare parts for three (3) years normal operation except as indicated otherwise.

7.6.46.2.1 Drinking Water Tank

(1) Type of Drinking Water Tank

Drinking water tanks shall be of earthquake proof construction and consist of a sandwich construction panel with facing materials comprising fiberglass reinforced polyester (F.R.P.) mad from unsaturated polyester resin and glass fiber of which the core shall be formed plastic.

(2) Materials

The unsaturated polyester resin to be used for the facing material shall be waterproof and weather proof and harmless to humane health.

The fiberglass shall be made from non alkali fiberglass as stipulated in JIS R 346~3417.

The foamed plastic materials to be used form the core shall be rigid and closed cell.

Any fillers and coloring agents shall be harmless to human heath.

(3) Accessories

The drinking water tank shall be provided with the following accessories.

(a)	Water inlet pipe connections (F.R.P.)	1 set
(b)	Water outlet pile connections (F.R.P)	1 set
(c)	Drainage pipe connections (F.R.P)	1 set
(d)	Connections for overflow hole and overflow With insecticide nets (The insecticide nets shall be made of plastic and the connections shall be made of F.R.P)	1 set
(e)	Air passage and air vent with insecticide nets (The insecticide nets shall be make of plastic and the passage ad vent shall be made of F.R.P)	1 set
(f)	Locking type manhole (Plastic Diameter : more than 500mm)	1 set
(g)	Reinforcing materials, support metals and stands for elevated water tank. (Rolled steel having properties in accordance with JIS G3101 and with dimensions and shapes in accordance with JIS G3192)	1 set
(h)	Steel ladder	1 set
(i)	Electrode mount	

(j) Breakwater cover 1 set

(4) Shapes, Dimensions and Performance

The shapes and dimensions of the elevated water thank shall be in accordance with the manufacturer's specifications, and the performance shall be as specified in " List of Equipment" in the Design Drawing.

7.6.46.2.3 Pressure Pump Unit

(1) Type

Pressure pump unit shall be factory built and factory tested product.

The unit is consist of two pumps, small pressure tank, control panel, necessary pipes, cable and pressure gauge these components are arranged on the common steel frame.

(2) System Operations

(a) In initial operation, one pump starts by push button provided on control panel and starts to supply water in the pressure tank. The pump stops when the pressure rise of the pressure tank.

(b) When by consumed water in the pressure tank the pressure in the pressure tank fall the other pump starts to run and supply water to pressure tank.

(c) All the signal of pumps START-STOP are controlled by a pressure switch provided on pressure tank.

(d) Specifications

Quantity	1 set
Discharge bore	40 mm
Tank Capacity	30 liters
Pump Quantity	2 set/ unit
Type	End section centrifugal motor closed coupled type
	End section centrifugal motor closed coupled type
Pump Speed	3,000rpm.
Materials Casing	Cast Iron
Shaft	Stainless Steel
Impeller	Bronze
Motor Type	Drip-proof, squirrel cage raptor
Voltage	400V
Frequency	50Hz.
Insulation Class	E

(4) Accessories

Check Valve JIS 10kg/cm2 50-2 pieces

Gate Valve JS 10kg /cm2 50 – 4 pieces

7.6.46.2.4 Water Supply Pump

(1) Type

Water supply pump shall be submergible pump, using of submerged motor and multistage centrifugal pump.

(2) Specifications

Liquid	Fresh water or equivalent
Temperature	0-40 ^{o}C
Impeller	Multi stage centrifugal
Shaft Seal	Oil Seal
Bearing	Sleeve bearing
Cashing	Cast Iron.
Impeller	Bronze
Shaft	Stainless Steel
Flange Standard	10kg/ cm2 thin type
Motor	Submerged canned type
Motor Insulation Class	E

(3) Accessories

10 meters water proof cable

7.6.46.2.5 Sterilizing Equipment

(1) Type

The sterilizing equipment shall be chlorine sterilizing type, including of sterilizing chemical tank chemical feed pump, flow sensor, necessary pipes and cables.

(2) Operation

The equipment shall be designed to inject the chemical in proportion to the flow rate of drinking water, using a diaphragm pump.

(3) Specification

(a) Sterilizing Chemical Tank

Material	:	Polyethylene
Volume	:	50 liter

(b) Chemical Feed Pump

Type Discharge variable diaphragm type

Output	:	0.025KW
Phase	:	1ø
Frequency	:	50 Hz
Voltage	:	AC 220V

(c) Flow Sensor

Flow sensor shall distribute electric pulse in proportion to the flow rate.

(4) Accessories

(a) Chemical feed pipe; high pressure blade hose 6mmø ; 3 m length
(b) Chemical suction pipe; vinyl pipe 5 mmø ;1 m length
(c) Pump base ; 1 set (including anchor bolts)
(d) Injection valve ; made of PVC ; 1 set
(e) Cable ; CVV 2 mm2 – 2C ; 3 m
(d) Sterilizing Chemical ; 1 set

7.6.46.2.6 Water Filter

(1) Type

Up-light casing, cartridge filtering element type

(2) Materials and Specification

Casing –stainless steel
Normal use maximum pressure – stainless steel
Filtering element – exchangeable plastic cartridge (reusable by water washing type)

(3) Accessories

Spare filtering element	-	1 set
Drain Cock	-	1 set
Air Cock	-	1 set
Hole- in-anchor	-	1 set

7.6.46.2.7 Sanitary Equipment and Accessories

7.6.46.2.7.1 General

(1) All sanitary wares shall be of European standard high quality or equivalent to JIS A 5207.

(2) All fittings for sanitary wares shall be in accordance with European standard high quality JIS A 5514 or equivalent

(3) All accessories and visible sanitary wares such as faucets, flush valves and flushing pipes shall be nickel chromium plated.

7.6.46.2.7.2 Water Closet (Western/European Style)

- All Sanitary Fittings & Fixtures should be European Made as well as approved sample and design.

7.6.46.2.7.5 Wash Basing (For Lavatory)

(1) Wash Basin

V.C., 6.5 & wall hanging type

(2) Accessories

(a) Pillar cock (13mm)
(b) Angle type stop cock (13mm)
(c) Washer basin trap
(d) Back hanger
(e) Liquid soap holder (Vertical type 350 cc)

7.6.46.2.7.5 Wash Basin (For Battery Room)

(1) Wash Basin

V.C., 9.5 &

(2) Accessories

(a) Pillar cock (13mm)
(b) Eye bath
(Vertical flexible type, 13mm)
(c) Angle type stop cock (13mm)
with water supply pipe
(d) Wash basing trap
(e) Back hanger

(f) Liquid soap holder (push button type, 360cc)

7.6.46.2.7.6 Service Sink

(1) V.C. with Back

(2) Accessories

(a)	Sink faucet (20mm with feed seat)	:
(b)	Trap (S type)	:
(c)	Trap connection fixtures	:
(d)	Chain and stopper	:
(e)	Back hanger	:
(f)	Rim cover	:

7.6.46.2.7.7 Mirror

The mirror shall be frame-less and moisture proof, and the glass for mirror shall be 5mm thick and 360x455 mm in size, and in accordance with JISD 3202 (Float, Polished Plate Glass) or equivalent BDS standard.

7.6.46.2.7.5 Water Cock and Similar Items

The main structures constituting the septic tank shall be made of FRP (fiberglass reinforced plastic) having appropriate shape, dimensions and capacity. The structures shall have sufficient strength against soil pressure, water pressure, load etc. and shall be of a construction permitting easy inspection and cleaning. The functional requirements shall be as follows.

(1) Treatment Capacity

(a)	Accommodation treatment for	: 5 persons
(b)	Estimated daily average volume of waste	: 1 m^3 / day
(c)	BOD concentration in discharge water	: 90 ppm.

(2) Tank Equipment

The septic tank shall consists of blower unit, pre treatment tank and main tank and the equipment required for the tank shall be of the following specifications.

Blower Motor : 0.04 m3 / min, 0.2 KW, three Phase, 415V, 50 Hz x 1 set

Accessories : Distribution board and cable, air piping and required pertinent.

(3) Accessories

Sterilization Chemical : 1 set

Sanitary appliances shall conform to the following standards:

BDS 1162: 1987	Specification for Ceramic Wash Basins and Pedestals;
BDS 1163 : 1987	Specification for Vitreous Sanitary Appliances, Part-1, General Requirements; Part-2, Specific Requirements for Water Closets; Part-3, Specification Requirements for Urinal (Bowl type); Part-4, Specific Requirements for Foot Rest; Part-5, Specific Requirements for Integrated Squatting Pans.
ASHRA E90A-80	Energy Conservation in New Building Design;
ASHRA E 90B-75	Energy Conservation in New Building Design;
AWWA C700-77	Cold Water Meter Displacement Type;
AWWA C701-78	Cold Water Meter Turbine Type Class-I;
AWWA C702-78	Cold Water Meter Turbine Type Class-II;
AWWA C702-78	Cold Water Meter Compound Type,
BS 1125: 1987	Specification for WC Flushing Cisterns (Including Dual Flash Cisterns and Flush Pipes);
BS 1244	Metal Sink for Domestic Purposes;
BS 1254:1981	Specification for C Seats (Plastics);
BS 1329:1974	Specification for Metal Hand Rinse Basins;
BS 1876: 1992 (1977)	Specification for Automatic Flushing Cistern for Urinals

TREATMENT PROCESS
OF
SEPTIC TANK

7.6.46.2.8 Piping Materials and Pipe Fittings

7.6.46.2.8.1 Pipe

(1) Water Supply Pipes

The water supply pipe shall be the steel pipe lined with rigid PVC in accordance with JWWA-K66.

(2) Drainage and Air Vent Pipes

The drainage and air vent pipes shall be the galvanized steel pipe in accordance with JIS G 3442, tar-epoxy coating steel pipe in accordance with JIS G3443 and HASS-210, and / or the centrifugal reinforced concrete pipe as specified in JIS A 5303.

7.6.46.2.8.2 Pipe Joint

(1) Water Supply Pipe Joints

The water supply pipe joints shall comprise screwed type and flange type. Screwed type pipe joints shall be malleable cast iron pipe joints coated with plastic in `accordance with JIS B2301. The flange type pipe joints shall be mad by welding the flange to the end surface of the steel made joints as stipulated in JIS B 2211 or JIS B2212, and further by lining the internal surface with rigid PVC of the same specification as that used for lining for lining of the steel pipe.

(2) Drainage and Air Vent Pipe Joints

The drainage and air vent pipe joints shall be malleable cast iron pipe joint in accordance with JIS B2301, screwed type drainage pipe joint in accordance with JIS B23.3 and rigid PVC pipe joint accordance with JIS K6739.

7.6.46.2.8.3 Gate Valves

The gate valve shall be the 10 kg. Cm2 bronze screwed or flanged type gate valve as stipulated in JIS B2023, and B2044.

7.6.46.2.8.4 Check Valves

The check valve shall be the 10 kg /cm2 bronze screwed or flanged swing check valve as stipulated.

7.6.46.2.8.5 Flexible Joints

The flexible joint shall be of a bellows type and shall have sufficient flexibility and resistance against pressure. The bellows and protective steel band shall be make of cold rolled stainless steel plate / sheet (SUS – 304) as stipulated in JIS G4305.
The length of one flexible section shall be 400mm.

7.6.46.2.8.6 Strainers

The strainer shall be of a Y type. The case the nominal diameter is 50mmm or less, the strainer shall be of a screwed type made of bronze, but in case the diameter is 65mm or over, the strainer shall be of a flanged type made of cast iron.

The clean out plug shall be make of brass, and the strainer element shall be made of stainless steel, one spare strainer element shall be furnished.

7.6.46.2.8.7 Drainage Pipe Fitting

(1) General

(a) The water sealing depth of trap shall be 50mm or more, and the effective area of the drainage hole for strainer shall not be less than the sectional area of the drainage pipe.

b) The nickel chromium plated section of the drainage pipe fittings shall be equivalent to or higher than Class 1 or Grade 2 in JIS H 8617 (Electroplated coating of Nickel and Chromium).

(2) Floor Drain Trap

The floor drain trap shall be made of cast iron and the strainer shall be nickel chromium plated brass. The floor drain trap for asphalt waterproofed floor shall be of a waterproofing type, but that for other floors shall be of an ordinary type.

(3) Floor Clean out

The floor clean out shall be of a screwed type made of brass having a nickel chromium plating finish. The floor clean out for asphalt waterproofed floor shall be of a waterproofing type, but that for other types of floors shall be of an ordinary type.

(4) Under floor Clean out
The under floor clean out shall be of a screwed type made of bras.

(5) Drainage Pipe Fittings
The drainage pipe fittings shall be make of brass having a nickel chromium plating finish and the chain and stopper shall be made of stainless steel.

7.6.46.2.8.8 Pipe Washers

The pipe washer shall be made of nickel chromium coated brass or stainless steel.

7.6.46.2.8.9 Pipe Sleeves

The pipe sleeve shall be made of steel pipe or steel plate with a thickness of 0.4mm or over (0.7mm or over in case the nominal diameter exceeds 200mm). However, the non-water proofed floor pope sleeve to be used indoors shall be made of laminated cardboard.

7.6.46.2.8.10 Pipe Support Fittings

(a) The pipe support fittings shall resistant to contraction and expansion, rolling etc. of pipe and be of a construction having sufficient bearing strength against load of pipe when liquid is contained inside. The materials to be used shall be in accordance with JIS G 3101 (Roll Steel for General Structure).

All steel fittings shall be finished by galvanizing.

(b) The inserts shall have sufficient strength for supporting the pipe and shall have a construction having suitable for connecting hangers etc. All inserts shall be made of cast iron, press formed malleable cast iron or steel plate.

7.6.46.2.8.11 Cementing /Bonding Materials

(1) Thread Sealing Materials

(a) The threat sealing tapes shall be in accordance with JIS K6885 (unsintered polytetrafluoroethylene tapes for thread sealing (raw tapes) , and shall neither be hazardous to human health nor cause adverse effects upon drinking water.

b) The paste sealing agent shall not be affected by the liquid in pipe and shall consist of contents applicable to the purpose of use. In case the agent is used for sealing of piping for drinking water, it shall not be hazardous to health nor cause any adverse effect upon drinking water.

(2) Packing(s)

The packing shall be in accordance with JIS K6353 (Rubber Goods for Water Works Service) JIS R3453 (Compressed Asbestos Sheets) etc. and have sufficient durability applicable to the respective quality of water, water pressure, temperature etc.

(3) Caulking Lead

The caulking lead shall, in principle be the 5th Class of those stipulated in JIS H2110 (Pig Lead).

(4) Caulking Hemp

The caulking hemp shall in principle be the jute of #130 single thread which, tied in a bundle has a diameter or about 25mm.

7.6.46.2.8.12 Basin and Basin Cover

(1) General

(a) The materials for iron castings shall be equivalent to of higher than Grade 3 as stipulated in JIS G5501 (Gray Iron Castings)

b) The iron castings shall be baked with refined tars in accordance with JIS K 2473 (Processed Tars) to which more than 2% of linseed oil or drying oil is mixed, or shall be cold painted with refined bituminous materials to which synthetic resin finishes added.

(2) Invert Basin

(a) The invert basing shall be of a concrete construction and all visible portions shall be finished by mortar, the basin shall be furnished with a cover and an invert applicable to the piper diameter shall be provided on the bottom of the basin.

(b) The cover shall be make of cast iron with chain, and shall be of an door proof type able to withstand the weight of 2,500kg.

(3) Drainage Basin

(a) The drainage basin shall be a concrete construction and all visible portions shall be finished by mortar coating. Moreover, the basin shall be furnished with a cover.

(b) The cover shall be made of cast iron with chain and shall be of an door proof type able to withstand the weight of 2,500kg.

7.6.46.3 Execution

7.6.46.3.1 Foundation Works

(1) The foundation shall be of reinforced concrete construction able to withstand the weight of equipment and external forces and having sufficient bearing surface for installation of equipment. The foundation shall be built on the floor or ground having sufficient bearing capacity.

(2) Cement to be used shall be the ordinary Portland cement in accordance with JIS R5210 (Portland Cement).

(3) Regarding the sizes of aggregate, the size of gravel shall be 25mm or less that of crushed stone shall be 20mm or less and that of sand shall be 2.5mm or less.

7.6.46.3.2 Erection Works

7.6.46.3.2.1 Drinking Water Tank

(1) The drinking water tank shall be firmly fixed with anchor bolts shaving sufficient strength so that the tank will not slide laterally nor move in any way due to horizontal seismic force.

(2) The drinking water tank shall be installed on a horizontal plane on the foundation having a steel made base and the foundation shall have an even bearing surface against the load. The tank and the steel base shall be fixed firmly with anchor bolts.

(3) After installation, the tank shall be cleaned and washed with water. Then, the tank shall be sterilized by using solution of hypochlorous acid, etc.

(4) The piping related to the tank shall be so supported that weight of the pipes not be applied to the tank.

Flexible joints shall be provided for all respective connecting pipes to the water tank except for the drain pipe and air vent pipe.

7.6.46.3.2.2 Wall Hanging Type Electric Water Heater

The wall hanging type electric water heater shall be set firmly on the wall by using expansion joints.

7.6.46.3.2.3 Sanitary Ware, Accessories and Fittings

(1) General

(a) In case wall hanging fittings are fixed on a concrete wall or brick wall, expansion bolts shall, in principle be used.

(b) In case a metal panel or lightweight steel framed board wall is set, steel plate and worked angle materials or hard wood patch shall be fixed to the sanitary ware in advance.

(c) In case a part of the sanitary ware is embedded in concrete, the portion of the sanitary ware that comes into contact with concrete or mortar shall be covered with asphalt having a thickness of 3mm or over. However, the bottom contact surface of sanitary ware, shall be filled with sand.

(2) Water Closet (Western/European Style)

(a) The upper end of the stool shall be set horizontally in place after deciding the precise setting positions.

(b) Prior to connecting the stool to the drain lead pipe the connecting end of the lead pipe shall be flared up to the diameter of the flange, and after inserting the non drink sealing materials between the external surface of the flange and connecting end the stool shall be connected to the drain lead pipe by nuts fastened from above by flange fittings and bolts. The plate thickness of the external end of the flared lead pipe shall not be less than 2mm.

Moreover, the end of the flange for the lead pipe to be connected to the stool shall be supported sufficiently with hangers etc. so that no load of drain pipe, etc, will act directly on the stool.

(3) Wash Basin

(a) The bracket or back hanger/s shall be firmly set in place, and the sash basins shall be fixed carefully so that the upper surface of the basing will be kept horizontal without exhibiting looseness. In order to eliminate leakage of water, heat resistant non drying sealing materials shall be filled around drain holes of the basins and around openings between the drain pipe fittings.

b) The setting height of the basins shall be 800mm (approximate) from the floor surface to the upper front end of the basins.

(4) Service Sink

The trap shall be set in place without any misalignment, and the connection of the sink to the drain pipe shall be carried out in accordance with the procedures for connection of stool in (2). Setting of back hanger(s) and connection between drain holes of the SINK and drain pipe fittings shall carried out I accordance with the procedures for the above wash basins in (4).

(5) Water Cock

The water cock shall be fixed firmly after precise centering by fully taking into account the convenience of use and harmony witty the surrounding facilities.

A sufficient space for the spout shall be provided between the end of the spout of water cock and the flood level rim of the drain receptacle.

(6) Mirror

The setting height of the upper end of the mirror shall 1,800 mm form the floor surface.

7.6.46.3.2.4 Septic Tank

Reinforced concrete foundation shall be provided and the tank shall be firmly fixed to the foundation so as to withstand upward water pressure.

7.6.46.3.3 Piping

7.6.46.3.3.1 Water Supply And Water Hydrant Piping

(1) General

(a) Prior to execution of piping work, detailed study shall be made on the relationship between other piping and equipment, and all positions for pipe laying shall be decided by taking into account the precise slope of the respective piping.

In the case where piping is laid inside a building, setting of the pipe support fittings and embedding of pipe sleeves shall be carried out without any delay and in accordance with progress of the work.

(b) The flange joints shall be inserted for all main piping at appropriate intervals in order to ensure easy removal of such piping.

(c) In the case where any piping is branched from the main piping, T-joints shall be used.

(d) As air release valve shall be provided at the dead air space portion in piping, and a mud discharge valve shall be provided at the portion where mud is collected. The size of the mud discharge valve shall be the diameter of the related pipe, provided that the size of the valve shall be 25mm in case the nominal diameter of the pipe exceeds 25mm.

(e) In case any anti-sweat covering is not provided for piping, pipe washers shall be fixed to all portions of piping that penetrate through ceiling, floors, walls etc and is visible from the outside.

(f) Any openings between the piping that penetrates through fire service areas etc. shall be filled with rock-wool heat insulation or other non-combustible materials.

(g) In case where a pipe sleeve is used at a place requiring water tightness, lead caulking shall be provided in the opening between the sleeve and pipe.

(h) In the case where any steel pipe and similar materials are laid under the ground, such pipe shall be protected against corrosion by either a double coating of coat tart or a double winding of corrosion proof vinyl tapes (JIS Z 1901 "Protective Polyvinyl Chloride Tapes).

(i) Any repair of steel pipe, cast iron pipe and lead pipe with caulking shall be prohibited.

(j) After completion of piping work, the inside of the piping shall be cleaned by water pressure on the occasion of hydrostatic test of the piping. In the case of piping for drinking water. The piping shall be sterilized until free residual chlorine of 1.2ppm or over has been detected at the end of the piping.

(2) Gradient

In the case of horizontally running pipe, the up feed pipe shall have an upward slope and the down feed pipe shall have a downward slope. In principle, the gradient shall be 1/250.

(3) Support Pitch

(a) The support pitch of the horizontally running pipes shall, in principle, be in accordance with the values in the following table and, wherever necessary , all bent sections and branching sections shall be supported. In the case where steel pipes or similar pipes are supported with hangers, a steady rest shall be provided for each horizontally running pipe in order to avoid looseness of the pipe due to movement at the time of earthquake.

(b) A steady rest shall be provided for indoor vertical pipe at least at one spot on every floor.

Table-12.1 : Maximum Support Pitch of Water Supply Pipe

Nominal pipe diameter	20 or less	25 – 40	50 – 80	100 – 150	200 or more
Support pitch	1.8	2.0	3.0	4.0	4.0

7.6.46.3.3.2 Drainage and Air Vent Pipe

(1) General

(a) All horizontally branched drainage pipes, etc. shall be combined nearly horizontally at an acute angel of less than 45^{o}.

(b) In case bent lead pipe is used, the pipe shall be carefully fabricated so as not to impair its roundness, and no branch drainage pipe shall be taken for protection.

(c) No waste water shall be discharged directly form the form the following equipment.

- Air conditioners

- Drinking water tank
- Pumps

(d) Indirect drainage pipe shall be opened while maintaining a space of over twice the diameter of the pipe from the drain receptacle and flood level rim. In case an obstacle is foreseen in providing the above opening, appropriate measures shall be taken for protection.

(e) The lowest portion of the vertical drainage pipe shall be fixed with a support stand where necessary.

(f) Any air vent pipe shall be run out vertically or at an angle of less than 45^{o} from the horizontally branched drainage pipe and in no case shall the pipe be run out horizontally.

(g) In the case where air vent pipes on floors are connected to vertical air vent pipes, the said pipes shall be connected at the place over 150mm from the flood level rim of the related equipment. Vertical air vent valves shall be connected to the stack vents in accordance with the above procedures.

(h) In case a hump pipe is buried, a pit shall be excavated from the lower ad of the pipe to depth of about 100mm in case the nominal diameter of the pipe is 300mm. After unscrewed crushed stone, unscreened gravel or pike sand has been laid and compacted, the pipe shall be laid. However, the portions where joints are provided shall be excavated further if necessary.

Initial back filling of pipe shall be carried out up to the center line of the pipe to ensure immovability, and after sufficient compaction, the pipe shall finally be buried.

Provisions other than those described in this paragraph shall be in accordance with the general provisions in 12.3.4.1.

(2) Gradient

The gradient of horizontally running drainage pipes said inside a building shall be 1/ 100. All air vent pipes shall have an upward slope facing the vertical pipes and shall be free from reverse slope and unevenness.

(3) Support Pitch

(a) The support pitch of steel pipes shall be in accordance with the applicable provisions in Table 12.1.

(b) Horizontally running cast iron pipes shall be supported at a pitch of less than 1.6m, and the deformed fittings to be connected shall be supported at a pit of less tan 0.6m, respectively.

7.6.46.3.3.3

(1) Connection of Pipes

(a) All pipes shall be carefully cut at a right angle against the axial center of the pipes so as to avoid any deformation of the sections, and the cut end shall be finished smoothly.

(b) All pipes shall be connected after removing any chips, dust and other foreign matter and after confirming that all such foreign matter has been completely removed form inside the pipes.

(c) In case piping work is temporarily suspended, all pipes shall be sufficiently protected to avoid entry of any foreign matter.

(2) Water Supply Piping

(a) No water supply piping shall in principle, be connected according to an insertion system unless specified otherwise.

(b) Epoxy resin or synthetic rubber rust inhibitors shall be sufficiently coated over the end face of threaded portions and the bottom of threaded portions of joints. All rust inhibitors to be applied for any drinking water piping shall be applied for any drinking water piping shall be harmless to human health and shall cause no harmful effect to the quality of drinking water.

(3) Drainage and Air Vent Piping

(a) Prior to connecting the galvanized steel pipes, the pipes shall be correctly threaded so that a slight clearance is provided between the end face of pipes and the recess of joints in order to obtain the tapered threaded pipe portion. Then, the steel pipes shall be screwed tightly into the joints.

(b) All case iron pipes shall be connected by using rubber rings. In this case, the pipes shall be inserted into the rubber rings until the end of spigot comes into contact with the bottom of socket. Then, the rubber rings that have been inserted into a position near the end of spigot in advance shall be inserted into the pipes carefully so that no twisting will occur in the opening between the socket and spigot. Then, the rubber rings shall be set in close contact with the pipes while uniformly fastening the tap bolts and nuts using a junk ring.

(c) Al rigid PVC pipe shall be carefully connected by a cold working method so that no step will occur between the connected pipes. The flow of water in the piping shall be smooth and uninterrupted.

(d) All centrifugal reinforced concrete pipes shall be connected by using collars.

After both ends of the pipes have achieved tight contact with each other at the central part of the collar and carefully set in place to ensure proper alignment in the surrounding opening, stiff consistency mortar shall be placed into the opening. In this case, all cement and water inside the pipes shall be thoroughly removed. In case one end of a pipe is made into a socket form after connecting a collar to the end with mortar, mortar shall be placed about 10mm away from the pipe end.

7.6.46.3.4 Antisweat Covering

7.6.46.3.4.1 Materials

The anti sweat covering materials, exterior and auxiliary materials shall be as specified in Table below.

Table - 12.2.1 : Antisweat Covering Materials, Exterior and Auxiliary Materials (1/2)

Classification of materials	:	Specifications
Heat insulation materials		
Glass wool heat materials	:	The glass wool heat insulation tubes shall be in accordance with JIS A9505 (Glass wool heat insulation materials) or equivalent
Exterior Materials		
Galvanized Sheets	:	The galvanized sheets shall be in accordance with grade 2 in JIS G3302 (Galvanized Sheets.) The standard thickness of original sheet shall be 0.3mm when the sheet is used for insulating pipes, valves, etc. with an outside diameter of 250mm or less, but in other cases, the thickness shall be 0.4mm.
Cotton Cloth	:	The weight of cotton cloth shall be 115g or more per $1m^2$ In case, the cloth is used for pipe, etc. it shall be cut into appropriate widths of a tape form.
Glass Cloth	:	The glass cloth shall be non-alkali plain glass sloth obtained by processing EP211C into a non-fraying type as stipulated in JIS R3414 (Glass Cloth).
PVC Type (Vinyl Tape)	:	The PVC tape shall be non-tacky tape of medium gloss with a thickness of 1.2mm in accordance with JIS Z1901 (Protective Polyvinyl Chloride Tapes).
Waterproofing Temp cloth (Linen)	:	The waterproofing linen shall be Hossian cloth No. 7 as stipulated in JIS L 2405, over one side of which blown asphalt, as stimulated in JIS K2207 (Petroleum Asphalt), has been coated. The linen shall be cut into a tape form of an appropriate width in case it is used for waterproofing of pipes etc.

Table -12.2.2 : Antisweat Covering Materials, Exterior and Auxiliary Materials (2/2)

Classification of materials	:	Specifications
Auxiliary Materials		
Molding base paper	:	The base paper shall be molding base paper of 370g more per m^2.

Asphalt roofing : The asphalt roofing shall be the one manufactured in accordance with JIS A6006 (Asphalt Roofing Felts) (Fiber Base) (Self-Finished Bitumen Felts), and more than 17kg per roll (21 m^2).

Iron Wire : The iron wire shall be the one as stipulated in JIS G3532 (Barbed Wires) which has been galvanized.

Steel Frame : In principle, the steel frame shall be the one made of steel sheet with a standard thickness of the original sheet of 0.4mm or more as stipulated in JIS G 3302 (Galvanized Sheets)

Adhesive PVC Tape : The adhesive PVC tape shall be in accordance with JIS Z1525 (Pressure Sensitive Adhesive Polyvinyl Chloride Tapes) with a thickness of 0.2mm.

Band and toothed lock washer : The band toothed lock washer shall have a thickness of 1.2mm or more, and shall be made from the materials in accordance with JIS G4305 (Cold Rolled Stainless Steel Strips), or JIS H3201 (Brass Plates). However, the ones made from brass shall be finished by nickel chromium Plating.

The width of band shall be 20mm.

Adhesive : In principle, acrylic emulsion adhesive shall be used for adhesion of glass cloth, glass filament mat and aluminum glands cloth. Vinyl acetate adhesive shall be used for adhesion of formed polystyrene heat insulation materials, and the chloroprene rubber adhesive for adhesion of rivets.

7.6.46.3.4.2 Execution

(1) General

(a) The thickness of insulation shall be that of the main insulation material and shall not include the thickness of exterior materials and auxiliary materials.

(b) The clearance between mutual insulation materials shall be as small as possible, and in no case shall joints for overlapping sections be provided on the same line.

(c) Band and tube shaped covering shall be tightly bound with galvanized wire. Bands shall be bound at a 50mm pitch and tubes shall have two windings at least three places per tube. All overlapping portions and joints of tubes shall be joined together by using adhesive tapes.

(d) In principle, the width of tape winding shall be 15mm or more, and taint of other overlapping portions shall be 35mm or more. In the case of water-proof linen wrapping, galvanized wire shall be wound twice over the wrapping at an interval of 2m, then asphalt primer shall be coated twice of the windings.

(e) Tapes shall be wounded starting form the lower part and then proceed to the upper part of piping. Should there be any possibility of deviation in case of polyvinyl chloride tape, etc., such deviation shall be eliminated by using adhesive tapes etc.

(f) The lagging plate over the insulation of the pipe shall e carried out in abed over form, and that of the vent section shall be carried out into a fan form.

(g) Shake-proof washers shall be attached to the ends of heat insulation sections for indoor piping, and bands shall be attached to branch and bent sections of the piping.

(h) The ends of heat insulation sections shall be protected as required depending upon the types and purposes of heat insulation materials to be used.

(2) Materials and Sequence of Works according to the types of heat insulation

The materials and the sequence of work according to the types of heat insulation are as indicated in Table 12.3.

Table - 12.3

Type of Covering Work	Materials and Sequence of work	Remarks
	(I) Glass wool heat insulation materials	
A	1. Heat Insulation tube 2. Galvanized Wire 3. Rough Paper 4. Cotton Cloth	Outdoor exposed piping
B	1. Heat Insulation Tube 2. Galvanized Wire 3. PVC Tape	Inside Ceiling and pipe Shaft

(3) Thickness of the Heat Insulation (Coverings)

The thickness of the insulation shall be as indication in Table 12.4.

Table - 12.4 : Thickness of Insulation

(Unit: mm)

Nominal dia. Type	10	20	25	32	40	50	65	80	100	Remarks
I water supply drainage piping	20	20	20	20	20	20	20	20	25	Glass Wool

(4) Heat Insulation (Coverings) for water supply pipes (including joints and valves)

(a) The materials and sequence of works according to the types of work shall be in accordance with Table 12.3.

(b) The thickness of insulation shall be in accordance with Table -12.4.

Table 12.5

Place of application	Materials and sequence of work	Thickness of Insulation
Indoor exposed piping	a	I
Piping inside ceiling and pipe shaft	a	I

(5) Anti sweat Covering

(a) The materials and the sequence of work according to the types of work shall be in accordance with Table 12.3.

(b) The thickness of the insulation (Covering) shall be in accordance with Table 12.4.

Table - 12.6

Place of application	Materials and sequence of work	Thickness of insulation
Indoor exposed piping	a	I
Piping inside ceiling and pipe shaft	b	I

(6) No insulation shall be provided for the following pipes, valves and flanges.

(a) Devices and piping 9including drainage pipe on the floor below sink) which are considered accessories for sanitary wares.

(b) Piping for water supply and drainage underground or inside concrete.
(c) Water supply piping laid indoors (excluding the piping to be laid inside ceilings and highly humid areas).
(d) Hot water supply piping valves and flanges .
(e) Out door exposed drainage piping.
(f) Air vent piping (excluding the portion of 100mm from the branch point of drainage pipe).
(g) Overflow pipes and drain pipes for various tanks and similar equipment.

7.6.46.3.5 Painting Work

(1) General

All respective equipment and materials, except the following, shall be painted.
Equipment and materials, except those requiring corrosion proof painting to be buried.

(2) Painting
The types of paints and frequency of painting of portions to be painted shall, in principle, be as specified in Table 12.7.

7.6.46.3.6 Civil Works

Items other than those specified in the following shall be in accordance with the specification/s for "Reinforced Concrete Works"

(1) The pit for piping under the ground shall be so excavated that the required gradient can be kept precisely and the piping can be connected easily.

(2) The foundation and pit for tanks, etc. shall be excavated sufficiently taking into account the space for assembly and removal of forms.

Table - 12.7.1 : Types of Paints and Frequency of Painting of Respective Portions (1/2)

Portions to be painted			Frequency of painting			Remarks
Equipment and members	Conditions		Primer Painting	Inter Coating	Face Coating	
Supports, racks and similar fittings (Other than galvanized materials	Exposed	Ready-mixed paint or aluminum paint	2	1	1	The primer coating shall be anti-corrosive pain
	Canceled	Anti-corrosive	1	-	1	
Heat-insulate exterior (cotton and cloth)	Exposed	Ready-mixed paint	1	1	1	The primer coating shall be sealer coating
	Canceled	Sealer coat	1	-	1	
Hear-insulated exterior (Glass cloth)	Canceled	Synthetic resin emulsion paint	1	1	1	After the glass cloth has been precisely bonded and made sufficiently dry, synthetic resin emulsion paint as stipulated in JIS K 5663 shall be used.
	Exposed	Polyvinyl chloride resin enamel	1	1	1	After the glass cloth has been precisely bonded and made sufficiently dry, emulsion putty shall be applied twice and after surface finish with paper file, resin enamel shall be applied.

Table - 12.7.2 : Types of Paints and Frequency of Painting of Respective Portions (2/2)

Portions to be painted			Frequency of painting			Remarks
	Types of paints					
Equipment and members	Conditions		Primer painting	Inter canting	Face Coating	
Heat-insulate exterior(Galvanized iron plate/board)	Exposed	Ready-mixed paint	1	1	1	The primer coating shall be anti-corrosive paint
				2nd		
				Coating		
Lined steel pipes and coated steel pipes including joints	Exposed	Ready-mixed	2	1	1	The primer coating shall anti-corrosive paint.
	Canceled	Anti-corrosive paint	1	-	1	Excluding resin-coating joints.

7.6.46.4 Test

7.6.46.4.1 Hot Water Storage Tank

The hydrostatic test shall be carried out for the instantaneous type electric water heater.

The hydrostatic test pressure shall be 17.5 kg/cm2 (shortest)

7.6.46.4.2 Water Supply Pipes

The hydrostatic test of water supply pipes shall be carried out prior to coating work during piping work or prior to shielding and backfilling or after completion of piping. The minimum pressure retention time shall be 60 minutes.

The test pressure of piping below elevated water tanks shall be twice the pressure equivalent to the static head.

7.6.46.4.3 Drainage Pipes

The water filling test of the drainage pipes shall be carried out prior to coating work during piping work or prior shielding and back filling or after completion of piping. The water passage test of sanitary drain pipes shall be carried out after sanitary wares etc. have been attached. The minimum water retention time in case of water filling test shall be 30minutes or more and that in case of the water passage test shall e 15 minutes or more.

7.6.46.4.4 Test of Raw Water

After the completion of the water receiving tank and water suction pump, the contractor shall test the quantity and quality of the raw water collected form the well.

The test shall be in accordance with article 4 (Water Quality Standard) of water service law of Japan.

The test items shall be as follows :

- Cyanide
- Mercury
- Organism Mercury
- Organism Phosphorus
- Lead
- Chromium
- Arsenic
- Fluorine
- Cadmium
- Nitrogen of nitric acid
- Colon bacilli's

The results of the tests shall be submitted to the Engineer.

7.6.46.4.5 Test of Treated Water

After the completion of drinking water system, the contractor shall test the quality of the treated water collected from the cocks. The test shall be in accordance with article 4 (Water Quality Standard) of water Service Law of Japan.

The test items shall be as follows :

- Turgidity
- Chromatizitat
- Stench
- Taste
- Potential of hydrogen
- Organic matter
- Nitrogen of ammonia
- Chlorine Iron
- Evaporation
- Solvable material
- Total hardness
- Iron
- Manganese
- Copper
- Zinc

The result of the test shall be submitted to the Engineer.

7.6.47 Air Conditioning and Ventilation Equipment Work

7.6.47.1 General

7.6.47.1.1 Scope

This clause covers the performance of all air conditioning and ventilation equipment works in accordance with the drawings and these specifications.

(1) Air Conditioning Equipment

(2) Ventilation Equipment

The contractor shall submit shop drawings of fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installations, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation. The contractor shall submit the result of tests at designated date specified.

7.6.47.1.2 Design Basis of Air Conditioning and Ventilation System

(1) Outdoor

Maximum Temperature	36^{o} C	Dry Bulb
Minimum Temperature	28^{o} C	Wet bulb
Minimum Temperature	12^{o} C	Dry bulb

(2) Indoor
Temperature

25^{o} C	Dry bulb	Control room
27^{o} C	Dry bulb	Otherm rooms (summer)
22^{o} C	Dry bulb	Other rooms (winter)

Humidity	60%	Control room
(Relative humidity)		Other rooms

7.6.47.2 Equipment And Materials

The equipment, materials and accessories as specified herein shall be furnished together with spare parts for three (3) years normal operation except as indicate otherwise.

7.6.47.2.1 Package Air Conditioning Units

(1) The Contractor shall furnish and install the package air conditioning units as shown in the drawings. Package air conditioning units shall be factory built and factory tested products.

(2) In this work, tow types of package air conditioning units shall be installed.

(3) Air heat source heat pump package air conditioner.

(a) Type Light weight, up right floor standing type.
(b) Cabinet Synthetic resin paint baked on finished plates.

(c)Insulation Insulation shall be installed to prevent sweating and to muffle sound, using glass wool on polywreten form.

(d) Condenser Air source heat pump condenser.

(e) Compressor Compressor (s) shall be serviceable hermetic type equipped with suitable rubber vibration isolators crank case heaters, liquid line strainer and suction and discharge shut off values.

(f) Air Filter Permanent washable polyvinyl chloride.

(g) Heat Exchanger Multi pass cross fined tube.
(h) Connections With flare nut or companion flange for field piping.
(i) Outdoor Fan Propeller Fan.
(j) Evaporator Multi pass cross finned tube
(k) Evaporator Fan

Multi-brade centrifugal Fan
AC- 1 (see drawings) direct drive
AC- 2 (see drawings) belt drive

(l) Applicable power supplies

AC 3-phase 400V 50Hz.

(m) Operation switch

3-position push button types and cooling heating selection switch (Ventilating operation, cooling operation or heating operation.

(n) High Pressure Switch

This switch cuts out the operation of compressor when the discharge pressure exceeds the setting.

(o) Accessories

Spare Parts

Refrigerant - for 1 change

V. belt - 1 each

7.6.47.2.2 Fans

(1) The Contractor shall furnish and install the fans as shown in the drawings. Fans shall be factory tested products.

(2) The capacities of the fans shall be in accordance with fan schedules as shown. Unless otherwise directed, the fans shall conform to the layouts as shown the drawings.

(3) All fans shall be statistically and dynamically balanced to avoid vibration and shall have blades to secure quiet efficient operation.

7.6.47.2.3 Ducts

Duct materials shall conform to the followings:

Galvanized steel iron sheet
Shape Steel
Bolt
Nut
Gasket for flange

7.6.47.2.4 Refrigerant Pipe Materials and Accessories

(1) The pipes shall be of copper. The material shall be as specified in JIS H3603 (Phosphorus deoxidized copper seamless pipes and tubes) and the dimensions shall be as specified in ASTM B8858L (Hard materials).

(2) The joints shall be molded products made from the above materials and they shall pass the manufacturer's standards. In locations where removal is required, flair or flanged joints shall be provided.

7.6.47.3 Installation Work

7.6.47.3.1 Foundation Work

(a) Foundation shall be of reinforced concrete construction and shall be able to withstand the weight of equipment and external forces by having sufficient bearing face. Moreover, the foundation shall be constructed on floor or ground having sufficient bearing capacity.
(b) Cement to be used for foundation shall be the standard Portland Portland cement in accordance with BDS 232 (Portland Cement).

(c) In principle, the size of aggregate shall be the following values

Gravel	:	25mm or less
Grouse Stone	:	20mm or less
Sand	:	2.5mm or less

Provisions other than those specified above shall be in accordance with the specifications for "Reinforced Concrete Work"

7.6.47.3.2 Installation Work for Equipment(S)

All equipment's shall be firmly secured to the floor so that the equipment will o move or be damaged due to earthquakes, etc.

7.6.47.3.3 Duct Work

(1) The Contractor shall furnish and install all sheet metal ducts for supply, return, fresh air and exhaust systems as shown in the drawings.

(2) Ducts shall be constructed to standards outlined in the latest HASS Guide. Ducts shall be constructed of galvanized steel gauges as shown Table 13.1.

Table - 13.1

Duct Size	Metal Gauge	Thickness
Less than 450	#26	0.5mm
455 ~ 750	#24	0.6mm
755 ~ 1500	#22	0.8mm
1501 ~ 2250	#20	1.0mm
More than 2260	#18	1.2mm

(3) The contractor shall clean all dirt and rubbish from the interior and exterior of all ducts and other accessories prior to erection.

(4) A flexible connection shall be made between the fan discharge and the adjoining duct work.

(5) Low-velocity ducts shall be installed as follows :

Table - 13.2 : Duct Flanges

			Bolt		Rivet	
Thickness	**Shape Steel**	**Max. Pitch**	**Dia.**	**Pitch**	**Dia.**	**Pitch**
0.5mm	25x25x3	3.6m	8.0mm	100mm	4.5mm	65mm
0.6	25x25x3	3.6	8.0	100	4.5	65
0.8	30x30x3	2.7	8.0	100	4.5	65
1.0	40x40x3	1.8	8.0	100	4.5	65
1.2	40x40x5	1.8	8.0	100	4.5	65

Table - 13.4 : Duct Hangers

Thickness	Shape Steel	Steel Rod Dia.	Max. Pitch
0.5mm	25 x 25 x 3	9mm	3.0m
0.6	25 x 25 x 3	9	3.0
0.8	30 x 30 x 3	9	3.0

1.0	40 x 40 x 3	9	3.0
1.2	40 x 40 x 5	9	3.0

(6) Spiral Duct

(a) The straight portion of the spiral duct shall be fabricated, using a strip of the galvanized steel sheet. The nominal size of the spiral duct shall be based on the inside diameter. The tolerance in inside diameter shall be +0 ~ +2 mm in reference to the nominal size. The thickness of the iron strips to be used shall be as indicated in Table 13.5.

Table - 13.5 : Thickness of Spiral Duct

Air Duct Diameter (mm)	Thickness (Gauge No.) of iron strips
Below 200	0.5mm (#26)
Over 200, but below 600	0.6mm (#24)
Over 600, but below 800	0.8mm (#22)
Over 800, but below 1,000	1.0mm (#20)

The pitch of the side seaming at the straight portion of the spiral duct shall be as indicated in Table 13.6 and the folding width shall be over 6mm.

Table - 13.6 : Side Seaming pitch of spiral Ducts

Air Duct diameter (mm)	Seam Pitch (mm)
Below 100	Below 100
Below 1,000	Below 150

(b) The jointing of one spiral duct to another shall be preformed by applying as many side seaming as required, using galvanized steel strips or welding as many steel strips arranged properly between spiral joints.
The galvanized steel strips shall be applied, in advance, with rust preventive paint on both inner and outer sides.

The nominal size of spiral duct joints shall be based on the outside diameter of the spiral duct joints, and the tolerance in nominal size shall be as indicated in Table 13.7.

Table - 13.7 : Tolerance in spiral duct Joint Diameter

Nominal Size (mm)	Tolerance (mm)
Below 600	- 1.5 - 2.5
Over 600, but below 1,00	- 2.0 - 4.0

The thickness of the galvanized steel strips to be used for the joint between spiral air ducts shall be as indicated in Table 13.8.

Table - 13.8 : Thickness of Galvanized iron Strips and Steel Strips

Nominal Size (mm)	Thickness (Gauge No)
Below 200	0.6mm (#24)
Over 200, but below 600	0.8mm (#22)
Over 600, but below 800	1.0mm (#20)
Over 800, but below 1,000	1.2mm (#18)

The overlapping width between steel strips used for the spiral duct joint shall be as indicate in Table 13.9.

Table : 13.9 : Overlapping width between iron strips or steel strips

Nominal Size (mm)	Overlapping Width (mm)
Below 125	60
Over 125, but below 300	80
Over 300, but below 1,000	100

(c) Spiral duct reinforcement

The reinforcement for spiral ducts shall be as per Table 13.10.

Table : 13.10 : Reinforcement for Spiral ducts

			Rivet	
Air Duct Diameter (mm)	Reinforcing angle steel	Mounting Interval (mm)	Dia. (mm)	Pitch (mm)
Over 600, but below 750	30 x 30 x 3	Below 2,400	4.5	65
Over 750, but below 1.200	30 x 30 x 3	Below 1,800	4.5	65
Over 1,210	40 x 40 x 3	Below 1,200	4.5	65

(7) Air duct support

(a) The hangers and supports for the rectangular air duct shall be made of shape steel or gar steel. The shapes and dimensions of the hangers and supports shall be as per Table 13.4

(b) The hangers and the supports for the circulars hanger shall be as per Table 13.12.

Table - 13.12 : Shape and dimensions of the hangers and supports for the circular air duct

		Hanger		**Support**	
Dia. Of circular air duct	Flat steel (mm)		Max. mounting interval	Flat Steel (mm)	Max. mounting Interval (mm)
Below 1,500	25x3	Bar steel with a size of 25x3 or 9mmø bar steel	2,700	25 x 3	2,700

Over 1,500	30x3	Bar steel with a size of 30x3 or 12mmø bar steel	2,700	30 x 3	2.700

(8) A canvas sheet shall be used for the connection between the air duct and the air blower or between the air duct and the air exhauster so that the vibrations from the air blower or the air exhauster may not propagate to others.

(9) Where the air duct is install penetrating through a wall, a through part both on the was side and the duct side shall be finished to a good appearance.

(10) The checking access port shall be such as will allow the case of opening and closing and as will permit air leakage. The access port cover shall be made of the galvanized sheet iron having the same thickness as that of the sheet iron for the air duct. Particularly, the access port cover at a location where the air from the air conditioner flows shall have insulating material to the thickness of more than 25mm.

(11) After, the installation, the interior of the air duct shall be cleaned thoroughly and check if there is no interference in the air flow.

(12) Outdoor air intake and exhaust louver

The outdoor intake louver and exhaust louver shall be made of the stainless steel sheet having the thickness of more than no. 20 gauge.

The effective area of the louvers shall be over 40%, and those louvers, which are installed at such locations where they are exposed to weathers, shall be designed and manufactured to be of such a construction as will prevent rain water from getting inside.

(13) Diffusers

(a) The diffusers to be used shall have a good appearance, and they shall by no means be allowed to generate noises during system operation. In addition, the diffusers shall be designed to be capable of providing normal performance.

(b) Universal Type diffuser

The mounting frame of the diffusers of this type shall be fabricated with steel or iron plate having a thickness of more than 1.0mm, and it shall have such a construction as the frame can be mounted to the air duct by means of bolts.

The diffuser blades shall permit the case of adjustment.

The shutter to be employed to the universal type diffuser shall be of the double access door type.

Unless otherwise specified, the diffuser of any type shall be made of galvanized steel sheet and shall be finished with melamine resin baked on the surface of each diffuser unit.

(c) The anemodiffusers to be used shall be used shall have sufficient air diffusing performance and they shall be provide with a damper and an air flow informing device.

7.6.47.3.4 Piping

(1) Cooling medium piping

(a) The insides of the pipes shall be thoroughly cleaned and dried before use.

After cleaning the ends of the pipes shall be sealed by an appropriate method to prevent an foreign matter from entering during the piping work.

(b) The pipes shall be normally cut perpendicular to the pipe center. The cutting shall be such that the pipe diameter is not decreased. The outer surfaces of connecting pipes and the inner surfaces of joints shall be polished sufficiently with a flux brush, etc. After the outer surface of the pipes is coated with flux, they shall be carefully inserted in the joints and fit perfectly while heating.

(c) The discharge and intake gas tubes shall have a minimum downward gradient of at least 1.200.

(d) The piping shall be performed in consideration of expansion and contraction.

(e) In flanged joints, a packing of a thickness within 1.5 mm as specified in JIS R3453 (Compressed asbestos sheet) shall be used.

(f) A by- pass between the pipe diameter and the same diameter shall be provided in cooling medium filters, automatic expansion valves, cooling medium solenoid valves, etc.

(g) The pitch for hoist and support fixture's shall be as shown in table 13.3.4.

Table - 13.13 : Copper Pipe support pitch

Pipe support pitch Nominal Diameter B	6	8	12	16	20	25	32	40	50	65	75	100
Max. Pitch (m)	1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.5	2.5	3.0	3.0

(h) To prevent the transmission of vibrations, anti-vibration joints, and anti vibration hoist and support fixtures shall be used.

7.6.47.3.5 Insulation Work

7.6.47.3.5.1 Materials

(a) The contractor shall furnish and install all insulation materials required for ductwork as shown in the Drawings.

(b) Specifications for heat insulation coverings.

Table - 13.14

Classification of heat insulation covering		Specifications
Heat insulation materials	Glass wool heat insulation	The glass wool heat insulation board shall be shall be No. 2 40K stipulated in JIS A 9505 (Glass Wool Heat Insulation Material).
Exterior materials	Glass cloth	The glass clothes shall be the non-alkali plain weave clothes stipulated in EP 21C in JIS R3414 (Glass clothes) which have been made free from fraying.
	Aluminum	The glass clothes shall be the flat weave clothes made of aluminum foil with a thickness of 0.02 mm or over stipulated in JIS H 4160 (Aluminum and aluminum Alloy foils), to which the plain weave clothes made of 13 micron glass yarn and 200 single filament yarns according to JIS R3414 with a unit acrylic resin adhesive.

Table - 13.15

Classification of heat insulation coverings		Specifications
Auxiliary	Glass filament Rivet	The glass filament mat shall be made of glass yarn of materials 18 micron of less according to JIS R 3413 and have a unit mat weight of 45 g of over per m2. The rivet shall be made of the washer made of galvanized steel plate to which a nail with a length to be changed depending upon the thickness of heat insulation materials is built in, or the copper plated nail for spot welding, and have a strength sufficient to bear the insulation materials.
	Steel frame	In principle, the steel frame shall be made of steel plate

		with a standard plate thickness of 0.4 mm or over as stipulated in JIS G 3302 (Galvanized sheets)
	Adhesive	In principle, the acrylic emulsion adhesive shall be used for bonding of glass clothes, glass filament mat and aluminum glass clothes, and the chloroprene rubber adhesive shall be used for bonding of rivet.

(3) Materials and procedures depending upon the types of heat insulation work.

Classification of insulation work	Order of insulation work
Insulation of exposed interior	1. Rivetting
	2. Heat insulation board with a thickness of 50mm
	3. Corner patch and seal-up
	4. Adhesive
	5. Glass clothes
Indoor concealing	1. Rivet
	2. Heat insulation board with a thickness of 25 mm
	3. Corner patch and seal-up
	4. Adhesive
	5. Aluminum Glass clothes

Note : The galvanized steel plate with a thickness of 0.2 mm or over shall be used for corner patch, and the glass filament mat shall be used for seal- up.

7.5.47.3.5.2 Execution

(1) The mutual clearance between the respective insulation shall not include the thickness of exterior materials or auxiliary materials.

(2) The mutual clearance between the respective insulation shall as small possible, and no overlapping joints shall be provided on the same line.

(3) In principle, two rivets shall be driven into the lower and side surfaces and one rivet into the upper surface of the air duct at intervals of 300mm each.

(4) The portion or air duct penetrating through the floor shall be covered with stainless steel from the floor surface to height of up to 150mm in order to protect the insulation

(5) The outermost ends of the insulation shall be protected as required depending upon the materials and purpose of heat insulation.

(6) Heat insulation work for inspection doors, etc. of equipment requiring such insulation shall be carried out so as not to cause hindrance during opening and closing of such doors, etc. nor deterioration of the said heat insulation.

7.6.47.3.6 Painting Work

7.6.47.3.6.1 General

(1) All equipment and materials, except for the following , shall be painted.

(a) Surfaces other than galvanized surfaces

(b) Galvanized portions which are normally concealed

(2) All equipment and materials requiring inspection shall be painted after inspection.

7.6.47.3.6.2 Painting

The types of paints and frequency of painting of the respective portions shall, in principle, be as specified in Clause 11.3.5 Unless specified in this table, such painting shall be carried out according to similar items taking into account the work purposes, materials and other conditions.

7.6.47.5 Tests

7.6.47.5.1 Piping

(1) The refrigerator shall pass the air-tightness and pressure withstand tests.

(2) The refrigerators shall be test operated in the factory and careful investigations concerning performance, noise, vibrations, etc. shall be performed. After it is confirmed that the tests have been passed, the refrigerator shall be shipped after applying rust-proof paint.

(3) After installation, the refrigerators shall be test operated.

(4) After completing of the refrigerant piping, an air-tightness test shall be performed using carbon dioxide, nitrogen, dry air, etc. After the air-tightness test, the entire system shall under-go high vacuum evaporation to remove all water. After this dehydration treatment, a cooling medium leak test shall be performed according to the inspection of the Engineer.

7.6.47.5.2 Duct

After completing the air duct installation, the air duct system shall have and air blow test in the presence of the Engineer. Unless otherwise specified, all of equipment, materials and execution shall be as stipulated in “Indoor Lighting System”.

7.6.48 Secondary-Electrical Wiring

7.6.48.1 General

(1) The contractor shall furnish and install the control panels, switches, receptacles, electrical conduit pipes, wires, outlet box for secondary wiring equipment as shown in the Drawings.

(2) Motors used in cooling equipment, blowers pumps, etc. shall all be included in this equipment work.

(3) Unless otherwise specified, the wire conduit and wiring work in the primary side shall all be performed as separate electrical equipment work. However :

(a) Secondary side wire conduit and wiring work for cooling equipment operating panels and below shall all be part of the work of the equipment concerned.

(b) Wire conduit and wiring work related to the automatic control of air conditioning equipment shall all be part of the work of the equipment concerned.

(c) Insufficient water level alarm equipment for water supply tanks, etc. shall be a part of the work of the equipment concerned.

(4) Unless otherwise indicated in this clause, all of equipment, materials and execution shall be as stipulated in "Indoor Lightening Plug and Telephone Piping System"

7.6.48.2 Equipment And Materials

(1) Cables shall be as shown in Table - 14.1.

Table - 14.1(1)

Items	Code No	Type	Letter
Control cable CVV	JIS C3401	Polyvinyl	Chloride
Insulated and Sheathed control Cables			
Cross-linked Polyethylene Insulated Cable CV	JIS C3606	Cross-linked	Polyethylene

(2) The electrical equipment and materials shall meet the standards of the Japanese Electrical manufacturers Association (JEM) in addition to these specifications.

(3) Motors

(a) Unless otherwise specified, AC motors shall meet the specifications in Table 14.2.

Motor Specifications	JIS 4201	Low-Voltage Three Phase Induction Motor
Voltage	400 G	
Insulation class	E	

(b) Three-phase induction motors shall be those using the starting equipment in Table 14.3. as standard.

Table 14.3

Area Capacity(kw)	Refrigerating equipment		Blowers	
	Motor	Starting system	Motor	Starting system
37 or more	High voltage wound type	Resister	High voltage wound type	Resister
15 ~ 37	Low voltage special	Y-A	Low voltage special squirrel	Y-A
11 ~ 15	Low voltage special squirrel	Y-A	Low voltage special squirrel	Y-A
5.5 ~ 7.5	Low voltage special squirrel	Direct starting	Low voltage special squirrel	Direct starting
37 or less	Low voltage normal type	Direct starting	Low voltage normal type	Direct starting

7.6.48.3 Test

Upon completion of the work, the whole system shall be proved acceptable by inspections carried out by the Engineer.

7.6.49 Lighting, Plug and Telephone Piping System

Principle of Lighting

The essential features of an efficient lighting system are :

- visual comfort through adequate illumination of the working surface, prevention of glare, and avoidance of shadows,
- ease of maintenance.

The design of a lighting system shall involve :

a) careful planning of the brightness and colour pattern within both the working areas and the surroundings so that attention is drawn naturally to the important areas, detail is seen quickly and accurately, and the room is free from any sense of gloom or monotony,
b) use of directional lighting to assist perception of task detail,
c) controlling direct and reflected glare from light sources to eliminate visual discomfort,
d) minimizing flicker from certain types of lamps and paying attention to the colour rendering properties of the light,
e) the correlation of lighting throughout the building to prevent excessive differences between adjacent areas, so as to reduce the risk of accidents, and
f) the installation of emergency lighting systems, where necessary.

7.6.49.1 Scope of Work

Concealed Electrical wiring by Eastern/BRB cable or equivalent

- European Made MK type Gang switch, socket MCB etc
- Provision for Internet facilities system, Telephone & Intercom wiring.
- Sufficient Earthlings facilities.
- To be used LED Light.

The scope of work under the contract includes supply and installation of lighting fixtures, lighting panel, switches, receptacles, electrical conduit pipes, wires, outlet boxes for telephones, internet, dish cable and other necessary accessories for the indoor lighting system.

7.6.49.2 Design Conditions

7.6.49.2.1 Illumination Level

1) The illumination levels for each room shall be as shown in Table - 15.2.1.

Table - 15.2.1

Name of Room	Normal condition	Emergency condition
Control	500 lx	50 lx
Office	300 lx	10 lx
Relay	300 lx	10 lx
PLC/ SCADA	500 lx	50 lx
Conference	300 lx	10 lx
Battery	100 lx	5 lx
Rectifier Set	100 lx	5 lx
Corridor	100 lx	5 lx
Pump Control	100 lx	5 lx
Cable Control	50 lx	5 lx
B/G	200 lx	5 lx
Lavatory	100 lx	-
Kettle	100 lx	-

(2) Setting Height

(a) Lighting fixtures
Refer to Design Drawings.

(b) Switches
1.25 meters above the floor level, unless otherwise specified.

(c) Receptacles
0.3 meters above the floor level, unless otherwise specified.

(3) Power source voltage

(a) For lighting panel
AC 3 phase 4 wires 415/230 V 50 Hz
DC 2 Wires 110 V

(b) For normal lighting, convenient outlet and ventilation equipment.
AC 1 phase 2 wires 220 V 50 Hz

(c) For emergency lighting
DC 2 Wires 110 V

7.6.49.3 System Description

(1) AC, DC Source and earthling shall be supplied from the primary side.

(2) Standard LED Lamps shall be provided for the control room and all miscellaneous rooms, and shall be designed to be manually activated by means of the switches at the entrance of each room. The lamps in the corridor, Toilet room, office and all electrical rooms shall be sensor based which will automatically switched "ON" and off.

(3) LED Lamp/Incandescent lamps shall be provided in all parts of the control building to serve as emergency lighting. The lamps in the control room, corridor, office and all electrical rooms shall be automatically switched "ON" in case of AC failure.

(4) Outlet boxes for telephones shall be provided for the control room, together with piping from the outlet boxes to the cable tray in the cable control room. The sitting of the telephones and wiring shall be included in the electrical scope of work of Lot IV.

(5) Exit sign light

The exit sign lights shall be mounted above the all exits of the control building.

(6) Spare parts, as indicated below, will be supplied for three (3) years normal operation.

7.6.49.4 Equipment's and Materials

7.6.49.4.1 Wires

Wires shall be as shown in the Table 15.4.1

Table - 15.4.1

ItemCode No.		Type Letter
Vinyl wire	JIS C3307	600 Grade Polyvinyl
IV		
Chloride Insulated Wires		
Heat- resistant	JIS C3317	Heat- resistant vinyl
HIV		
	Insulated wire	

HIV wires shall be used in the DC circuit.

7.6.49.4.2 Wire Connectors

Wire connectors for indoor wiring shall be in accordance with JIS C2810 or equivalent BDS

7.6.49.4.3 Metal Conduit and Fittings

Metal conduit and fittings shall be in accordance with the Table 15.4.3, and the conduit shall be of heavy gauge type.

Table 15.4.3

Item	Code No.	Designation
Conduit	JIS C8305	Rigid metal Conduit (heavy gauge)
Coupling	JIS C8330	Coupling for Rigid Metal Conduit
Normal Bend	JIS C8330	Elbows for Rigid Metal conduit
Bushing	JIS C8331	Bushing for Rigid metal Conduit
Locknut	JIS C8333	Locknuts for Rigid Metal Conduit
Saddle	JIS C8334	Saddles for Rigid Metal Conduit
Universal	JIS C8335	Universal Fittings for Rigid metal Conduit
Outlet Box	JIS C8337	Out Boxes for Rigid metal Conduit
Switch Box	JIS C8337	Switch Boxes for Rigid Metal Conduit
Concrete Box	JIS C8338	Concrete Boxes for Rigid Metal Conduit
Box Cover	JIS C8339	Box covers for Rigid Metal Conduit
Insulated Bushing	JIS C8347	Insulated Bushing for rigid Metal Conduit

7.6.49.4.4 Pull Boxes

Pull boxes shall be made of steel and coated with protective paint, and wherever exposed to view, shall be coated with a finish paint of a color approval by the Engineer.

7.6.49.4.5 Wiring Devices

Wiring devices shall be in accordance with the Table-15.4.5

Table-15.4.6

Items	Code No.	Designation

Fluorescent Lamp	JIS C7601	Fluorescent Lamps for General Lighting Service
Rapid Start	JIS C7602	Instantaneous Start Hot cathode Discharge Fluorescent Lamps (40 W type)
Glow Starter	JIS C7607	Glow starters for fluorescent Lamps (Less than 40 W type
Fluorescent fixture	JIS C8106	Lighting Fitting for Fluorescent Lamps
		ballasts for Fluorescent lamps
Incandescent lamp	JIS C7501	Double Filament Lamps for General Use

7.6.49.4.6 Lighting Fixtures

(a) In Principle shapes and dimensions shall be in accordance with the Drawings. Catalogs and shop drawings shall be submitted to the Engineer for approval.

(b) Lighting fixtures for emergency use shall be as specified by BCJ (Articles rated by the Building Center of Japan), or approved equal.

7.6.49.4.7 Lighting Panel

Shapes, electrical characteristics, types capacities of circuit breakers, and the system of operation shall be in accordance with the Drawings.

The panel shall made of steel plate with a thickness of more than 1.6mm (body) and 2.3 mm (door) respectively.

The finish shall be painted with a color approved by the Engineer. Catalogs and shop drawings shall be submitted to the Engineer for approval.

7.6.49.4.8 Over Current Protectors

Molded case circuit breakers and residual current protective devices shall be of European Standard used in the lighting panel

7.6.49.5 Indoor Wiring

7.6.49.5.1 Rigid Metal Conduit

(1) Installation

(a) Imbedding or conduit laying shall be so made that the strength and structure of the building is not affected.
(b) Cut ends of conduit shall be neatly and smoothly finished by instrument such as a reamer.
(c) Conduit shall be bent at a radius of more than six (6) times the internal diameter of the conduit conduit running between outlets and pulling boxes shall not have more than the equivalent of four 90^{o} bends.
(d) A pull box or junction box shall be installed to protect conduit exceeding 30 meters in length and at the points required.
(e) In general, a switch or outlet box shall be used at all points where a switch, receptacle (socket) or lighting fixture is to be provided.
(f) Where low voltage metal conduit is enclose in proximity to or crosses communication wiring, metallic water pipe or gas pipe, the work shall be so done that direct contact is avoided.

(2) Connection of conduits

Conduit and fittings shall be perfectly connected, both physically and electrically, and the conductor resistance shall be preferably dept within 2 ohms between grounding conductor and the end metal conduit.

(3) Pull Boxes and Junction Boxes

(a) Shape and type of these boxes shall suit the place of installation and a steel plate or more than 1.2mm in thickness shall be used.
(b) Boxes shall have adequate dimensions well matching the number or conduits connected and the condition of connecting or pulling wires.
(c) Where the box is covered or concealed in structural material, access to the box shall be made possible to facilitate inspection.

(4) Installation of feeder conduits

(a) Exposed main conduit shall, in principle, run parallel with wall or ceiling.
(b) Metals supports for conduit in concrete building shall have a proper fixing insert or bolt previously embedded in the concrete.
(c) Spacing between metal inserts or bolts to support conduit shall in principle, be approximately 2 meters.

(5) Painting, Protection and cleaning of Conduit

(a) Where the plated or painted surface of conduit, metal support or box has peeled off, it shall be touched up with protective paint.
(b) Conduit shall be sufficiently protected against entry of moisture, water, dust etc. and the cut end of conduit shall be bush be capped, wood plugged or covered with rag, etc. Whenever concrete work is in progress.

(c) Conduit and boxes shall be well cleaned and the conductivity checked after removal of the forms.

(6) Wire Pulling

(a) Connection of wire shall not be made inside metal conduit. Connection shall be made in metal box, junction box or distribution board.
(b) Wire shall be pulled through conduit after the inside of conduit has been cleaned and when each of conduit has been capped with bushing. Cleaning shall be performed in such a manner that walls, ceilings, etc. around the conduit are not stained or spoiled in any way.
(c) In all cases, all wires stemming from one circuit shall be accommodated in the same conduit for A.C circuit work, except where a balanced condition is electro-magnetically attained by accommodating both lines of the same polarity within the same conduit.

7.6.49.6 Installations

7.6.49.6.1 Installation of Lighting Fixtures

(a) Heavy lighting fixtures shall be firmly supported using inserts, studs or bolts, attachments and if necessary shall be provided with a means to prevent swinging by using wood screw, etc.
(b) Lighting fixtures shall be installed horizontally or vertically in a workmanlike manner and shall be so located as to not interfere with inspection of related equipment.

7.6.49.6.2 Installation of Lighting Panel

Lighting panel shall be installed firmly on walls or other surfaces in a workmanlike manner, and shall be so located as to not interfere with inspection of related equipment.

7.6.49.6.3 Test

A performance test shall be made be made after installation of equipment has been completed.

7.6.49.7 Grounding

7.6.49.7.1 Grounding Resistance

Grounding resistance shall be 10 ohms on less, unless otherwise specified.

7.6.49.7.2 Electrical Works to Be Grounded

Except for specific instances, all electrical that the respective grounding resistance values are kept at specified values throughout the year despite seasonal changes.

(a) No grounding is required for steel base, metal box and steel frame of equipment is operated on less than AC150 V (Voltage to ground) and is installed at a dry location.
(b) Metal conduit and metal accessories

(c) Metal enclosure accommodating the discharge lamp ballast and the metal parts or a discharge lamp lighting fixture, except where grounding is required and/or when so directed by Engineer, shall be grounded.

7.6.49.7.3 Sign, Signal & Annotation:

- Integrated Design of Different kind of Indicators like- Acrylic Sign Board, LED Sign Board, Neon Sign Board, Reception Sign Board, Safety Sign, PVC Letters, Glow Sign Board, Customized Display Boards, Overhead Signage, Metal Nameplates, Commercial Sign Boards, Outdoor Signs, Electronic Sign Boards etc. should be provided in the design & construction.

- Digital LED Signboard with the features of excellent visibility (even in daylight); Good quality at reasonable price and light weight; Simple installation, Safe to touch and clean; Changing color for attracting attention; Extremely low power consumption.

- Should be provided the Accessories like Adaptor and chains etc.

LED display screen shall be minimum 1.0 square meter. Shall be Compatible with IP65.
Shall be installed at the front side wall of the building
Environmentally friendly display it ensures lower power consumption and longer lifetime.

7.7 Pre-commissioning Test of Substation

(Test reports and documents required for substation commissioning)

Pre commissioning test report format & schedule shall be submitted to and approved by SE, System Protection & Testing-Commissioning, BPDB, Dhaka or Director, Design & Inspection-2, BPDB, Dhaka.

The pre-commissioning test must be witnessed by BPDB engineers and must be signed by the testing team members and witnesses. Description of the test equipment (must have calibration certificate) for each test shall be mentioned.

The below mentioned information and reports must be submitted to the office of the Directorate of Design & Inspection-2, BPDB, Dhaka and SPTC, BPDB, Dhaka at least **15 days** before the expected date of commissioning. Softcopy of the requested information and documents shall be emailed to dir.design2@bpdb.gov.bd / se.sptc@bpdb.gov.bd / dir.system.protection@bpdb.gov.bd.

All the pre commissioning test witness observations shall be complied & the relay settings have to be finalized as per BPDB's recommendation before commissioning.

7.7.1 Circuit Breaker (33 kV):

1. Name plate data
2. Insulation Test (Insulation resistance & DAR across open contact, Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
3. Closing/Opening operation check from Remote & Local, Closing Interlock check, Anti-pumping operation check
4. Closing/Opening timing check
5. Contact resistance check
6. Spring charge operation check, heating and illumination circuit functionality check

7.7.2 CT/PT (33 kV & 11 kV):

1. Name plate data
2. Insulation Test (Insulation resistance & DAR across Primary to Ground, Secondary to Ground, Primary to Secondary, Secondary 1 to Secondary 2, Phase to Phase etc. with minimum 5 kV test voltage for primary and 500 V test voltage for secondary / Power frequency withstand test (Hipot)/ Leakage current test/ tan δ test etc.)
3. Polarity & Ratio test
4. CT magnetization curve test
5. CT secondary winding resistance check

7.7.3 Control & Relay Protection Panel (33 kV):

1. Name Plate Data
2. Complete Relay test (Over current & Earth fault relay, Directional Over current & Earth fault relay (if applicable), Differential relay etc.

3. Primary injection test (Tripping & indication test of Over current & Earth fault relay, CT core allocation check, Single point earthing check)
4. Differential relay & Restricted Earth Fault relay tripping, indication and stability test
5. Master Trip relay, Trip circuit supervision relay, DC/AC fail relay and all other auxiliary relay functionality check
6. Closing/Opening operation check from CP & SCADA, Closing Interlock check, Anti-pumping operation check
7. Trip logic test
8. Alarm and indication circuit functionality check, Indicative meter and Energy meter check
9. Heating and illumination circuit functionality check
10. Wiring/ Ferrule Number/ Color Coding check as per drawing

7.7.4 Switchgear Panel (11 kV):

1. Name Plate Data
2. Insulation Test of Circuit breaker (Insulation resistance & DAR across open contact, Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
3. Insulation Test of Busbar (Insulation resistance & DAR across Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
4. Complete Relay test (Over current & Earth fault relay, Directional Over current & Earth fault relay (if applicable) etc.)
5. Primary injection test (Tripping & indication test of O/C & E/F relay, CT core allocation check, Single point earthing check)
6. Master Trip relay, Trip circuit supervision relay, DC/AC fail relay and all other auxiliary relay functionality check
7. Closing/Opening operation check from CP & SCADA, Closing Interlock check, Mechanical Interlock check, Anti-pumping operation check
8. Alarm and indication circuit functionality check, Indicative meter and Energy meter check
9. Closing/Opening timing check
10. Contact resistance check
11. Spring charge operation check, heating and illumination circuit functionality check
12. Wiring/ Ferrule Number/ Color Coding check as per drawing

7.7.5 Power Transformer:

1. Name plate data
2. Insulation Test (Insulation resistance, DAR & PI across HV to LV, HV to Ground, LV to Ground etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test/ tan δ test etc.)
3. Winding Resistance check
4. OLTC functionality check
5. Voltage Ratio check (At all tap changer positions)
6. Open circuit test (magnetizing current and no load loss measurement)
7. Short circuit test (At all tap changer positions)

8. Magnetic balance test
9. Vector group check
10. Bushing CT polarity & ratio test, magnetization curve test, secondary winding resistance check
11. Functionality check of cooling fan (Manual operation by WTI, OTI)
12. Functionality check and trip test of WTI, OTI, PRD, Buchholz relay (MT and OLTC) etc.
13. AVR functionality check (if provided)
14. Oil Test Report (Main Tank (Top & Bottom) & OLTC)
15. Heating circuit functionality check.

7.7.6 Disconnecting Switch/Isolator/Earthing Switch (33 kV & 11 kV):

1. Name plate data
2. Insulation Test (Insulation resistance & DAR across open contact, Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
3. Contact resistance check
4. Closing/Opening operation check, Mechanical Interlock check

7.7.7 Busbar (33 kV):

1. Busbar details (Size, Type and Capacity etc.)
2. Insulation Test (Insulation resistance & DAR across Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
3.

7.7.8 Underground Cable & Line Conductor (33 kV & 11 kV):

1. Underground Cable & Line Conductor details (Size, Type and Capacity etc.)
2. Insulation Test (Insulation resistance, DAR & PI across Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test/ tan δ test (for cable only) etc.)
3. Phase Sequence Check

7.7.9 Earthing Resistance Measurement (Desired value < 0.25 Ω):

1. Substation mesh earthing
2. CRP panel & Switchgear panel earthing
3. 33 kV CB/CT/PT/LA/Isolator etc. earthing
4. Power Transformer body & neutral earthing

7.7.10 ACR (33 kV & 11 kV): (Not applicable)

1. Name Plate Data
2. Insulation Test (Insulation resistance & DAR across open contact, Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
3. Primary injection test (Tripping & indication test of O/C & E/F protection)
4. Closing/Opening operation check from control unit
5. Closing/Opening timing check
6. Contact resistance check

7.7.11 DC System:

Charger:

1. Nameplate data
2. Functionality check (Boost charge, Float charge, Trickle charge etc.)
3. Protection check (Over voltage, Over load, Short circuit, Earth fault, Reverse polarity etc.)
4. Alarm & Indication check

Battery:

1. Nameplate data
2. Capacity test (Battery bank shall be discharged at rated current by applying load bank under charger switched off condition and voltage of each cell shall be measured at 30 minutes interval with a duration up to Cell EODV)

7.7.12 Attachments:

1. Approved Equipment Layout Drawing (33 kV Switchyard, Control Room, 11 kV Switchgear).
2. Approved Single Line Diagram along with relay model, CT ratio and load.
3. Approved Schematic diagram of CRP panel and Switchgear panel.
4. Approved General Arrangement (GA) drawing of Front View, Rear View, LHS view, RHS view of the panel.
5. Fault level calculation, CT sizing calculation.
6. Trip Matrix along with detail relay settings and related calculation for Line Feeder, Transformer feeder, Incomer Feeder and Outgoing Feeder.

SECTION 08

GUARANTEED TECHNICAL PARTICULAR (GTP)

OF

(PLANT & EQUIPMENT)

8.01(a). Guaranteed Technical Particulars of 33 KV Indoor Type Gas insulated switchgear (GIS) With Protection, Control and Metering Equipment (for Chakbazar New, Korbanigonj New, Hathazari new, Fakirhat new, Nasirabad new, Stadium upgradation New, Bakalia)

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

	DESCRIPTION	UNIT	BPDB REQUIREMENT	BIDDER'S GUARANTEED VALUES
1.	a) Manufacturer's name & address With website, official domain email.	-	Shall be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
2.	Type/ Model	-	Shall be mentioned	
3.	Manufacturer & country of origin	-	USA/UK/EU/Japan/ South Korea/Malaysia	
4.	Applied Standard	-	Latest version of IEC 62271 fully complied	
5.	Rated nominal Voltage	kV	33	
6.	Rated Voltage	kV	36	
7.	Rated Frequency	Hz	50	
8.	Material of Bus-Bar	-	HDHC Copper	
9.	Busbar Scheme	-	Single Bus with Bus Coupler	
10	Installation	-	Free Standing	
11.	Rated Current for Main Bus			
	Single Bus (As per scope)	Amps	2000	
12.	Cross Section of bus bar	mm^2	Min 1600 for 2000A Bus or (As per IEC62271)	
13.	Rated symmetrical short circuit breaking current for Single Bus	KA	31.5	
14.	Short time current rated duration	Sec.	3	
15.	Pressure relief device is integrated with each gas chamber	-	Yes	
16.	Mimic diagram is depicted in front of switchgear panel	-	Yes	
17.	Electrical and Mechanical interlock between Circuit breaker, isolator and earth switch	-	Yes	
18.	Capacitive Voltage Indicator with Interlock contact for ES operation	-	Yes	
19.	**Circuit Breaker:**			

	Type of interrupter	-	VCB	
	Class of Circuit Breaker (Supported by Type Test report)	-	E2M2 or better	
	Designation of Internal Arc Classification (Supported by Type Test Report)	-	IAC AFLR 31.5 kA, 1 Sec	
	Insulation media	-	SF_6	
	Interrupting media	-	Vacuum	
	Manufacturer's name and country of origin of vacuum interrupter	-	To be mentioned	
	Manufacturer's model no. of Vacuum Interrupter (Model no. shall be supported by Type Test)	-	To be mentioned	
	Guaranteed nos. of operation for Vacuum Interrupter			
	a) at rated Current switching	Nos.	Min. 10,000	
	b) at Short circuit current switching	Nos.	≥ 50	
	Rated Voltage	kV	36	
	Rated Current for Incoming as per scope	A	1250/2000	
	Rated Current for Outgoing	A	**1250**	
	Rated Current for Power Transformer	A	**1250**	
	Rated Current for Bus coupler (Single Bus) as per scope.	A	**2000**	
	Rated Short Circuit Breaking Current for Single Bus.	kA	**31.5**	
	Rated duration of short circuit current	sec	**3**	
	Rated Short Circuit Making Current for Single Bus.	kA	80	
	Rated Breaking time	Cycle	≤5	
	Opening time	Sec.	shall be mentioned	
	Closing time	Sec.	shall be mentioned	
	Rated operating Sequence	-	O-0.3 sec-CO-3 min-CO	
	Control Voltage	V	DC 110	
	AC Voltage for the Universal Motor for spring charge	V	AC 230	
	Power Consumption of Charging motor	W	Max 250	
	Power consumption of opening/trip coil	W	Max 300	
	Nos. of Trip coils	Nos.	2	
20.	**Three position disconnector Switch (Both Motor and Manual)**			
	Type/ Model	-	Shall be mentioned	
	Rated Voltage	kV	36	
	Rated Current for Incoming as per scope	A	1250	

	Rated Current for Outgoing	A	1250	
	Rated Current for Power Transformer	A	1250	
	Rated Current for Bus coupler (Single Bus) as per scope.	A	2000	
	Rated short time current for Single Bus.	kA	31.5	
	Short time current rated duration	Sec	3	
	Switch Position	-	close, open, earth	
	Electrical and Mechanical interlock	-	As per IEC 62271-200	
	Mechanical Endurance Class	-	Shall be mentioned	
21.	**Current Transformer :**			
	Type	-	Ring core/block type with sensor	
	Rated Voltage	kV	36	
	Accuracy Class, Metering	-	0.2 S	
	Accuracy Class, Protection	-	5P20	
	Rated Current Ratio for incoming as per scope	A	600-1200/5-5A	
	Rated Current Ratio (for Outgoing, Station Auxiliary Feeder)	A	400-800/5-5A	
	Rated Current Ratio (for Bus Coupler; Single Bus)	A	900-1800/5-5A	
	Rated Current Ratio (for power transformer panel)	A	400-800/5-5-5A	
	Burden for metering	VA	20 (at max CT ratio)	
	Burden for protection	VA	20 (at max CT ratio)	
	Extended Current Rating for metering	A	120 % of rated Current	
	Instrument Security factor (metering)	-	< 5	
	R_{CT} at 75^0 C			
	(a) Measuring Core	mΩ	shall be mentioned	
	(b) Protection Core	mΩ	shall be mentioned	
	Knee Point Minimum Voltage (Supported by Calculation)			
	(a) Measuring Core	V	shall be mentioned	
	(b) Protection Core	V	shall be mentioned	
	Rated frequency	Hz	50	
	CT burden shall meet the Short Circuit Current (31.5 kA, 3 Sec) (Supported by Calculation)	-	Yes	
22	**33 kV Cable Compartment: (For INCOMING/OUTGOING & TRANSFORMER Feeder)**			
	Material	-	Highly Conductive Copper	
	Bus bar type	-	Single	
	Cross Section	mm^2	Min 1600 for 2000A Bus	

			or (As per IEC62271)	
	Nominal Current	A	2000	
	Cable connection as per scope	-	1x1Cx800mm^2,1x1Cx500mm^2 (Incoming/Outgoing & Transformer Feeder Panels), 3Cx95 mm^2 for Auxiliary x-former XLPE armoured copper cable per phase as per scope of works section 6. Cable termination plug and socket with all accessories required for cable termination, suitable for terminating with proper cable support shall be provided. One spare cable connection facility for each GIS panel and Sealing/cap for unused cable termination shall also to be provided.	
23.	**Bus Voltage Transformer :**			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	33/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated burden, Secondary	VA	20	
	Accuracy class (Metering & Protection)	-	0.2 & 3P	
	LV Compartment	-	IP40	
24	**Line Voltage Transformer :**			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	33/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated Burden	VA	20	
	Accuracy class (Metering & Protection)	-	0.2 & 3P	
25.	**SF6 Safety and life**			
	SF6 Pressure	KPa	Shall be mentioned	
	Rated pressure at 20 degree C	KPa	Shall be mentioned	
	Bursting Pressure	KPa	Shall be mentioned	
	Gas leakage rate/year (Supported by Type Test report)	KPa	≤0.1%	
	Safety indication	-	To be incorporated	
	Capacitive voltage indicator	-	In the front of the panel	
	Gas pressure Manometer	-	As per IEC 62271-1	
	Bus Bar Gas pressure Manometer	-	As per IEC 62271-1	
	Life/ Endurance of switchgear switches			
	a) Circuit Breakers	-	As per IEC 62271-100	
	b) Disconnectors & Earthing switches	-	As per IEC 62271-102	
	Alarm level for insulation	Kpa	140	

	Rated filling level for insulation	KPa	150	
26.	**Dimension and Weight**			
	Height	mm	Shall be mentioned	
	Width	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
	Weight including Circuit Breaker	Kg.	Shall be mentioned	
27.	**Construction :**			
	a) Stainless steel tank	-	Shall be mentioned	
	b) Equipped with disconnector and earthing switch. The earthing switch shall have full fault-making capacity.	-	Shall be mentioned	
	c) Each gas filled compartment shall be equipped with density sensors giving alarm by low gas density.	-	Shall be mentioned	
28.	**Degree of Protection**			
	Enclosure	-	IP3X	
	HV Compartment	-	IP65	
	LV Compartment	-	IP40	
29.	**Insulation level :**			
	AC withstand voltage 1min. dry	kV	70	
	Impulse Withstand, full wave	kV	170	
30.	**Type Test Report (as per IEC 62271-200)**			
	Lightning Impulse Voltage Withstand tests	-	Shall be submitted	
	Power frequency withstand tests	-	Shall be submitted	
	Temperature/ Gas pressure Rise Tests.	-	Shall be submitted	
	Measurement of resistance of the main circuit.	-	Shall be submitted	
	Short circuit performance tests	-	Shall be submitted	
	Mechanical Endurance tests.	-	Shall be submitted	
	Arc fault test	-	Shall be submitted	
	Gas Leakage Test	-	Shall be submitted	
A. Protection Control & Metering (Transformer Feeder)				
31.	**Differential and Restricted Earth Fault Relay**			
	Manufacturer's Name	-	ABB- Sweden, Switzerland, Finland/ Siemens -Germany/ Schneider-France /UK / Alstom (UK/France)/ NR, China/ SEL, USA.	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	

	Type of Relay	-	Numerical programmable	
	Maximum through fault at which the protective equipment is stable with recommend settings:			
	a) Earth faults	rating % of CT rating	Shall be mentioned	
	b) Phase faults		Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	ms	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	There shall be total 42 BI in Transformer Feeder Panel	
	No of Binary Output (Minimum)	-	There shall be total 32 BO in Transformer Feeder Panel	
	No of Communication Ports i) Electrical ii) Optical	-	Shall be mentioned with type.	
	Protection Functions	-	Differential and Restricted earth fault protection (for a Two winding transformer considering Vector group of Dyn11) and other mandatory functions	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Range of current setting : (a) Earth Faults (b) Phase Faults	% of CT rating	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Percentage of current setting at which relay will reset.	%	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol	-	Yes	

32.	**Over Current & Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland / Siemens -Germany/ Schneider-France /UK/ Alstom (UK/France)/ NR, China/ SEL, USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable Multifunction	
	Range of current setting:	-		
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Each fault element		Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	There shall be total 42 BI in Transformer Feeder Panel	
	No of Binary Output (Minimum)	-	There shall be total 32 BO in Transformer Feeder Panel	
	No of Communication Ports iii) Electrical iv) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Non-Directional O/C, E/F Other Necessary Functions.	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Drop off to Pick up ratio	%	Shall be mentioned	
	Reset time after removal of fault current	Sec	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol	-	Yes	
33	**Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)**			

	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
34	**Trip Relay (Separate Relay) for Differential and O/C & E/F**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	ms	<10	
	Operating Coil Voltage- 110V DC	-	Yes	
	Self-reset type for O/C, E/F protection	-	Yes	
	Hand & Electrical reset type for Differential, REF and Transformer Self-protection	-	Yes	
35	**Separate Auxiliary Flag Relays for Transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank & OLTC.**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
36	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	30	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
37	**Control Switch**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
B. Protection Control & Metering (Incoming/Outgoing Feeder & Bus Coupler)				

38.	**Over Current & Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland/ Siemens -Germany/ Schneider-France /UK/ Alstom -(UK/France)/ NR- China/ SEL- USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	33kV Incoming/ Outgoing line feeders	

			numerical relay shall have both directional and non-directional O/C & E/F protection (IDMT, DMT, Inst.) feature with monitoring functions" 33kV Bus coupler feeders numerical relay shall have non-directional O/C & E/F protection (IDMT, DMT, Inst.) and synchro check feature with monitoring functions.	
	Range of current setting :	-		
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Each fault element		Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	24 for line Feeder, 32 for Bus Coupler	
	No of Binary Output (Minimum)	-	24 for line Feeder, 24 for Bus Coupler	
	No of Communication Ports v) Electrical vi) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Directional and Non-Directional O/C, E/F, Over/ Under Voltage, Over and Under Frequency, Sync Check And Other Necessary Functions.	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip	-	Shall be mentioned	

	circuit.			
	Drop off to Pick up ratio	-	Shall be mentioned	
	Reset time after removal of fault current	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol	-	Yes	

39	**Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
40	**Trip Relay (Separate Relay)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Operating Coil Voltage- 110V DC	-	Yes	
41	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	14	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
42	**Control Switch**			
	Manufacture's Name	-		
	Country of Origin	-		
	Manufacture's Model no.	-		
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
43	**Metering and Instrumentation (for Incoming/Outgoing, Power Transformer & Bus Coupler feeder)**			
	a) Energy Meter (Multi Tariff Programmable Meter) (N.B. Not applicable for Bus Coupler Panel)			
	Manufacture's Name	-	Shall be mentioned	
	Manufacture's Country		European Country/ North American Country/Japan/ Australia	

	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical programmable	
	Class of Accuracy	-	0.2 S	
	b) VOLT METERS with Selector Switch			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
	Bus Coupler panel shall have 2 nos. voltmeter with seven (7) position voltage selector switch	-	To be provided	
	c) Ampere Meters			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 240 degree scale range	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
C. Station Auxiliary Transformer Switchgear Unit				
44.	Manufacturer's Name & Address	-	To be mentioned	
45.	Manufacturer country of origin	-	USA/UK/EU/Japan/ South Korea/Malaysia	
46.	Type	-	Shall be mentioned	
47.	Rated nominal Voltage	kV	33	
48.	Rated Voltage	kV	36	
49.	Material of Bus-Bar	-	HDHC Copper	
50.	Rated Current for main bus			
	Single Bus (As per scope)	Amps	2000	
51.	Cross Section of busbar	mm^2	1600	
52.	Rated short time current	kA	31.5	
53.	Short time current rated duration	Sec.	3	
54.	**Circuit Breaker :**			
	Manufacturer's model no. of vacuum interrupter	-	Shall be mentioned	
	Rated Voltage	kV	36	
	Rated Current	A	1250	
	Rated Short Ckt. Breaking Current	kA	31.5	
	Rated duration of short circuit current	sec	3	
	Rated Short CKt. Making Current	kA	80	
	Rated Breaking time	Cycle	≤5	
55.	**TPS (DS-ES) (motor & manually operated)**			

	Rated Maximum Voltage	kV	36	
	Operating Mechanism	-	Shall be mentioned	
	Insulating media	-	SF6	
	Rated Current	A	1250	
	Rated short time current	kA	31.5	
	Short time current rated duration	Sec	3	
	Switch Position	-	close, open, earth	
	Electrical and Mechanical interlock	-	As per IEC 62271-200	
	Mechanical Endurance Class	-	Shall be mentioned	
56.	**Insulation level :**			
	AC withstand voltage 1min. dry	kV	70	
	Impulse Withstand, full wave	kV	170	
58.	**Degree of Protection**			
	Enclosure	-	IP3X	
	HV Compartment	-	IP65	
	LV Compartment	-	IP40	
59.	**Dimension and Weight**			
	Height	mm	Shall be mentioned	
	Weight	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
60.	**Type Test Report (as per IEC 62271-200)**			
	Lightning Impulse Voltage Withstand tests	-	Shall be submitted	
	Power frequency withstand tests	-	Shall be submitted	
	Temperature/Gas pressure Rise Tests.	-	Shall be submitted	
	Measurement of resistance of the main circuit.	-	Shall be submitted	
	Short circuit performance tests	-	Shall be submitted	
	Mechanical Endurance tests.	-	Shall be submitted	
	Arc fault test	-	Shall be submitted	
	Gas Leakage Test	-	Shall be submitted	
D. Protection Control & Metering for station transformer				

61	**Over Current and Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland/ Siemens –Germany/ Schneider-France /UK / Alstom (UK/France)/ NR, China/ SEL, USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical	

			programmable, multifunction with both directional and non-directional O/C & E/F protection (IDMT, DMT, Inst.) feature and monitoring functions.	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	24	
	No of Binary Output (Minimum)	-	24	
	No of Communication Ports vii) Electrical viii) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Non-Directional O/C, E/F Other Necessary Functions.	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Range of Current Setting a) Phase Fault Element b) Earth Fault Element	-	Shall be mentioned	
	Range of timing settings	-	Shall be mentioned	
	Drop off to Pick up ratio	-	Shall be mentioned	
	Reset time after removal of fault current	-	Shall be mentioned	
	Burden of Relay At 20 time CT rating.	VA	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol.	-	Yes	
62	**Trip Circuit Supervision (TCS) Relay (Separate Relay)**			

	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
63	**Trip Relay (Separate Relay)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
64	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	14	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
65	**Metering**			
	a) Energy Meter (Multi Tariff Programmable Meter)			
	Manufacture’s Name	-	Shall be mentioned	
	Manufacture’s Country	-	European Country/ North American Country/Japan/ Australia	
	Manufacture’s Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical	
	Class of Accuracy	-	0.2 S	
	b) Volt Meters			
	Manufacturer’s Name and Country	-	Shall be mentioned	
	Manufacture’s Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
	c) Ampere Meters			
	Manufacturer’s Name and Country	-	Shall be mentioned	
	Manufacture’s Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 240 degree scale range	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
66	Marking	-	“BPDB & Contract No.”	
67	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.01(b) Guaranteed Technical Particulars of 33 KV Indoor Type Gas insulated switchgear (GIS) With Protection, Control and Metering Equipment (for Baroaulia Upgradation)

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

	DESCRIPTION	UNIT	BPDB REQUIREMENT	BIDDER'S GUARANTEED VALUES
1.	a) Manufacturer's name & address With website, official domain email.	-	Shall be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
2.	Type/ Model	-	Shall be mentioned	
3.	Manufacturer & country of origin	-	USA/UK/EU/Japan/ South Korea/Malaysia	
4.	Applied Standard	-	Latest version of IEC 62271 fully complied	
5.	Rated nominal Voltage	kV	33	
6.	Rated Voltage	kV	36	
7.	Rated Frequency	Hz	50	
8.	Material of Bus-Bar	-	HDHC Copper	
9.	Busbar Scheme	-	Double with Bus Coupler	
10	Installation	-	Free Standing	
11.	Rated Current for Main Bus			
	Double Bus (As per scope)	Amps	3150	
12.	Cross Section of bus bar	mm^2	Min 2500 for 3150A Bus or (As per IEC62271)	
14.	Rated symmetrical short circuit breaking current for Double Bus	KA	40	
	Short time current rated duration	Sec.	3	
15.	Pressure relief device is integrated with each gas chamber	-	Yes	
16.	Mimic diagram is depicted in front of switchgear panel	-	Yes	
17.	Electrical and Mechanical interlock between Circuit breaker, isolator and earth switch	-	Yes	

18.	Capacitive Voltage Indicator with Interlock contact for ES operation	-	Yes	
19.	**Circuit Breaker:**			
	Type of interrupter	-	VCB	
	Class of Circuit Breaker (Supported by Type Test report)	-	E2M2 or better	
	Designation of Internal Arc Classification (Supported by Type Test Report)	-	IAC AFLR 31.5 kA, 1 Sec	
	Insulation media	-	SF_6	
	Interrupting media	-	Vacuum	
	Manufacturer's name and country of origin of vacuum interrupter	-	To be mentioned	
	Manufacturer's model no. of Vacuum Interrupter (Model no. shall be supported by Type Test)	-	To be mentioned	
	Guaranteed nos. of operation for Vacuum Interrupter			
	a) at rated Current switching	Nos.	Min. 10,000	
	b) at Short circuit current switching	Nos.	≥ 50	
	Rated Voltage	kV	36	
	Rated Current for incoming as per scope	A	2500	
	Rated Current for outgoing	A	1250	
	Rated Current for Power Transformer	A	1250	
	Rated Current for Bus coupler (Double Bus) as per scope.	A	3150	
	Rated Short Circuit Breaking Current for Double Bus.	kA	40	
	Rated duration of short circuit current	sec	3	
	Rated Short Circuit Making Current for Double Bus.	kA	102	
	Rated Breaking time	Cycle	≤5	
	Opening time	Sec.	shall be mentioned	
	Closing time	Sec.	shall be mentioned	
	Rated operating Sequence	-	O-0.3 sec-CO-3 min-CO	
	Control Voltage	V	DC 110	
	AC Voltage for the Universal Motor for spring charge	V	AC 230	
	Power Consumption of Charging motor	W	Max 250	
	Power consumption of opening/trip coil	W	Max 300	
	Nos. of Trip coils	Nos.	2	
20.	**Three position disconnector Switch (Both Motor and Manual)**			

	Type/ Model	-	Shall be mentioned	
	Rated Voltage	kV	36	
	Rated Current for incoming as per scope	A	2500	
	Rated Current for outgoing	A	1250	
	Rated Current for Power Transformer	A	1250	
	Rated Current for Bus coupler (Double Bus) as per scope.	A	3150	
	Rated short time current for Double Bus.	kA	40	
	Short time current rated duration	Sec	3	
	Switch Position	-	close, open, earth	
	Electrical and Mechanical interlock	-	As per IEC 62271-200	
	Mechanical Endurance Class	-	Shall be mentioned	
21.	**Current Transformer :**			
	Type	-	Ring core/block type with sensor	
	Rated Voltage	kV	36	
	Accuracy Class, Metering	-	0.2 S	
	Accuracy Class, Protection	-	5P20	
	Rated Current Ratio for incoming as per scope	A	1200-2400/5-5A	
	Rated Current Ratio (for outgoing, Station Auxiliary Feeder)	A	400-800/5-5A	
	Rated Current Ratio for (Bus Coupler; Double Bus as per scope)	A	1600-3200/5-5A	
	Rated Current Ratio (for power transformer panel)	A	400-800/5-5-5A	
	Burden for metering	VA	20 (at max CT ratio)	
	Burden for protection	VA	20 (at max CT ratio)	
	Extended Current Rating for metering	A	120 % of rated Current	
	Instrument Security factor (metering)	-	< 5	
	R_{CT} at 75^0 C			
	(a) Measuring Core	mΩ	shall be mentioned	
	(b) Protection Core	mΩ	shall be mentioned	
	Knee Point Minimum Voltage (Supported by Calculation)			
	(a) Measuring Core	V	shall be mentioned	
	(b) Protection Core	V	shall be mentioned	
	Rated frequency	Hz	50	
	CT burden shall meet the Short Circuit Current (31.5 kA, 3 Sec) (Supported by Calculation)	-	Yes	
22	**33 kV Cable Compartment: (For Incoming/Outgoing & Transformer Feeder)**			
	Material	-	Highly Conductive Copper	

	Bus bar type	-	Double	
	Cross Section	mm^2	Min 2500 for 3150A Bus or (As per IEC62271)	
	Nominal Current	A	3150	
	Cable connection as per scope	-	3x1Cx800mm^2,1x1Cx500mm^2 (Incoming/Outgoing & Transformer Feeder Panels), 3Cx95 mm^2 for Auxiliary x-former XLPE armoured copper cable per phase as per scope of works section 6. Cable termination plug and socket with all accessories required for cable termination, suitable for terminating with proper cable support shall be provided. One spare cable connection facility for each GIS panel and Sealing/cap for unused cable termination shall also to be provided.	
23.	**Bus Voltage Transformer :**			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	33/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated burden	VA	20	
	Accuracy class (Metering & Protection)	-	0.2 & 3P	
	LV Compartment	-	IP40	
24	**Line Voltage Transformer :**			
	Type/ Model	-	Shall be mentioned	
	Number of Phase	-	Single Phase	
	Rated Primary Voltage	kV	33/√3	
	Rated Secondary Voltage	V	110/√3	
	Rated Burden	VA	20	
	Accuracy class (Metering & Protection)	-	0.2 & 3P	
25.	**SF6 Safety and life**			
	SF6 Pressure	KPa	Shall be mentioned	
	Rated pressure at 20 degree C	KPa	Shall be mentioned	
	Bursting Pressure	KPa	Shall be mentioned	
	Gas leakage rate/year (Supported by Type Test report)	KPa	≤0.1%	
	Safety indication	-	To be incorporated	
	Capacitive voltage indicator	-	In the front of the panel	
	Gas pressure Manometer	-	As per IEC 62271-1	
	Bus Bar Gas pressure Manometer	-	As per IEC 62271-1	
	Life/ Endurance of switchgear switches			

	c) Circuit Breakers	-	As per IEC 62271-100	
	d) Disconnectors & Earthing switches	-	As per IEC 62271-102	
	Alarm level for insulation	Kpa	140	
	Rated filling level for insulation	KPa	150	
26.	**Dimension and Weight**			
	Height	mm	Shall be mentioned	
	Width	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
	Weight including Circuit Breaker	Kg.	Shall be mentioned	
27.	**Construction :**			
	b) Stainless steel tank	-	Shall be mentioned	
	b) Equipped with disconnector and earthing switch. The earthing switch shall have full fault-making capacity.	-	Shall be mentioned	
	c) Each gas filled compartment shall be equipped with density sensors giving alarm by low gas density.	-	Shall be mentioned	
28.	**Degree of Protection**			
	Enclosure	-	IP3X	
	HV Compartment	-	IP65	
	LV Compartment	-	IP40	
29.	**Insulation level :**			
	AC withstand voltage 1min. dry	kV	70	
	Impulse Withstand, full wave	kV	170	
30.	**Type Test Report (as per IEC 62271-200)**			
	Lightning Impulse Voltage Withstand tests	-	Shall be submitted	
	Power frequency withstand tests	-	Shall be submitted	
	Temperature/ Gas pressure Rise Tests.	-	Shall be submitted	
	Measurement of resistance of the main circuit.	-	Shall be submitted	
	Short circuit performance tests	-	Shall be submitted	
	Mechanical Endurance tests.	-	Shall be submitted	
	Arc fault test	-	Shall be submitted	
	Gas Leakage Test	-	Shall be submitted	
E. Protection Control & Metering (Transformer Feeder)				
31.	**Differential and Restricted Earth Fault Relay**			
	Manufacturer's Name	-	ABB- Sweden, Switzerland, Finland/ Siemens -Germany/ Schneider-France /UK / Alstom (UK/France)/ NR, China/	

			SEL, USA.	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable	
	Maximum through fault at which the protective equipment is stable with recommend settings:			
	a) Earth faults	rating % of CT rating	Shall be mentioned	
	b) Phase faults		Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	ms	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	There shall be total 42 BI in Transformer Feeder Panel	
	No of Binary Output (Minimum)	-	There shall be total 32 BO in Transformer Feeder Panel	
	No of Communication Ports ix) Electrical x) Optical	-	Shall be mentioned with type.	
	Protection Functions	-	Differential and Restricted earth fault protection (for a Two winding transformer considering Vector group of Dyn11) and other mandatory functions	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Range of current setting : (c) Earth Faults (d) Phase Faults	% of CT rating	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Percentage of current setting at which relay will reset.	%	Shall be mentioned	

	The relay shall have IEC 61850 communication Protocol	-	Yes	
32.	**Over Current & Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland / Siemens -Germany/ Schneider-France /UK/ Alstom (UK/France)/ NR, China/ SEL, USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable Multifunction	
	Range of current setting:	-		
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Each fault element		Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	There shall be total 42 BI in Transformer Feeder Panel	
	No of Binary Output (Minimum)	-	There shall be total 32 BO in Transformer Feeder Panel	
	No of Communication Ports xi) Electrical xii) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Non-Directional O/C, E/F Other Necessary Functions.	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Drop off to Pick up ratio	%	Shall be mentioned	
	Reset time after removal of fault current	Sec	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol	-	Yes	

33	**Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
34	**Trip Relay (Separate Relay) for Differential and O/C & E/F**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	ms	<10	
	Operating Coil Voltage- 110V DC	-	Yes	
	Self-reset type for O/C, E/F protection	-	Yes	
	Hand & Electrical reset type for Differential, REF and Transformer Self-protection	-	Yes	
35	**Separate Auxiliary Flag Relays for Transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank & OLTC.**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
36	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	30	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
37	**Control Switch**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	

F. Protection Control & Metering (Incoming/Outgoing Feeder & Bus Coupler Panel)

38.	**Over Current & Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland/ Siemens -Germany/ Schneider-France /UK/ Alstom -(UK/France)/ NR- China/ SEL- USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	33kV Incoming/ Outgoing line feeders	

			numerical relay shall have both directional and non-directional O/C & E/F protection (IDMT, DMT, Inst.) feature with monitoring functions" 33kV Bus coupler feeders numerical relay shall have non-directional O/C & E/F protection (IDMT, DMT, Inst.) and synchro check feature with monitoring functions.	
	Range of current setting :	-		
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Each fault element		Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	24 for line Feeder, 32 for Bus Coupler	
	No of Binary Output (Minimum)	-	24 for line Feeder, 24 for Bus Coupler	
	No of Communication Ports i) Electrical ii) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Directional and Non-Directional O/C, E/F, Over/ Under Voltage, Over and Under Frequency, Sync Check And Other Necessary Functions.	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip	-	Shall be mentioned	

	circuit.			
	Drop off to Pick up ratio	-	Shall be mentioned	
	Reset time after removal of fault current	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol	-	Yes	
39	**Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
40	**Trip Relay (Separate Relay)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Operating Coil Voltage- 110V DC	-	Yes	
41	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	14	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
42	**Control Switch**			
	Manufacture's Name	-		
	Country of Origin	-		
	Manufacture's Model no.	-		
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
43	**Metering and Instrumentation (for Incoming/Outgoing, Power Transformer & Bus Coupler feeder)**			
	a) Energy Meter (Multi Tariff Programmable Meter) (N.B. Not applicable for Bus Coupler Panel)			
	Manufacture's Name	-	Shall be mentioned	
	Manufacture's Country		European Country/ North American Country/Japan/ Australia	
	Manufacture's Model no.	-	Shall be mentioned	

	Type of Meter	-	Numerical programmable	
	Class of Accuracy	-	0.2 S	
	b) VOLT METERS with Selector Switch			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
	Bus Coupler panel shall have 2 nos. voltmeter with seven (7) position voltage selector switch	-	To be provided	
	c) Ampere Meters			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 240 degree scale range	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
G. Station Auxiliary Transformer Switchgear Unit				
44.	Manufacturer's Name & Address	-	To be mentioned	
45.	Manufacturer country of origin	-	USA/UK/EU/Japan/ South Korea/Malaysia	
46.	Type	-	Shall be mentioned	
47.	Rated nominal Voltage	kV	33	
48.	Rated Voltage	kV	36	
49.	Material of Bus-Bar	-	HDHC Copper	
50.	Rated Current for Main Bus			
	Double Bus (As per scope)	Amps	3150	
51.	Cross Section of bus bar	mm^2	Min 2500 for 3150A Bus or (As per IEC62271)	
52.	Rated symmetrical short circuit breaking current for Double Bus	KA	40	
53.	Short time current rated duration	Sec.	3	
54.	**Circuit Breaker :**			
	Manufacturer's model no. of vacuum interrupter	-	Shall be mentioned	
	Rated Voltage	kV	36	
	Rated Current	A	1250	
	Rated Short Ckt. Breaking Current	kA	31.5	
	Rated duration of short circuit current	sec	3	
	Rated Short CKt. Making Current	kA	80	

	Rated Breaking time	Cycle	≤5	
55.	**TPS (DS-ES) (motor & manually operated)**			
	Rated Maximum Voltage	kV	36	
	Operating Mechanism	-	Shall be mentioned	
	Insulating media	-	SF6	
	Rated Current	A	1250	
	Rated short time current	kA	31.5	
	Short time current rated duration	Sec	3	
	Switch Position	-	close, open, earth	
	Electrical and Mechanical interlock	-	As per IEC 62271-200	
	Mechanical Endurance Class	-	Shall be mentioned	
56.	**Insulation level :**			
	AC withstand voltage 1min. dry	kV	70	
	Impulse Withstand, full wave	kV	170	
58.	**Degree of Protection**			
	Enclosure	-	IP3X	
	HV Compartment	-	IP65	
	LV Compartment	-	IP40	
59.	**Dimension and Weight**			
	Height	mm	Shall be mentioned	
	Weight	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
60.	**Type Test Report (as per IEC 62271-200)**			
	Lightning Impulse Voltage Withstand tests	-	Shall be submitted	
	Power frequency withstand tests	-	Shall be submitted	
	Temperature/Gas pressure Rise Tests.	-	Shall be submitted	
	Measurement of resistance of the main circuit.	-	Shall be submitted	
	Short circuit performance tests	-	Shall be submitted	
	Mechanical Endurance tests.	-	Shall be submitted	
	Arc fault test	-	Shall be submitted	
	Gas Leakage Test	-	Shall be submitted	
H. Protection Control & Metering for station transformer				
61	**Over Current and Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland/ Siemens –Germany/ Schneider-France /UK / Alstom (UK/France)/ NR, China/ SEL, USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical	

			programmable, multifunction with both directional and non-directional O/C & E/F protection (IDMT, DMT, Inst.) feature and monitoring functions.	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	24	
	No of Binary Output (Minimum)	-	24	
	No of Communication Ports xiii) Electrical xiv) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Non-Directional O/C, E/F Other Necessary Functions.	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Range of Current Setting c) Phase Fault Element d) Earth Fault Element	-	Shall be mentioned	
	Range of timing settings	-	Shall be mentioned	
	Drop off to Pick up ratio	-	Shall be mentioned	
	Reset time after removal of fault current	-	Shall be mentioned	
	Burden of Relay At 20 time CT rating.	VA	Shall be mentioned	
	The relay shall have IEC 61850 communication Protocol.	-	Yes	
62	**Trip Circuit Supervision (TCS) Relay (Separate Relay)**			

	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
63	**Trip Relay (Separate Relay)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
64	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	14	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC /DC Dual Supply Provision	-	Yes	
65	**Metering**			
	a) Energy Meter (Multi Tariff Programmable Meter)			
	Manufacture’s Name	-	Shall be mentioned	
	Manufacture’s Country	-	European Country/ North American Country/Japan/ Australia	
	Manufacture’s Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical	
	Class of Accuracy	-	0.2 S	
	b) **Volt Meters**			
	Manufacturer’s Name and Country	-	Shall be mentioned	
	Manufacture’s Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
	c) **Ampere Meters**			
	Manufacturer’s Name and Country	-	Shall be mentioned	
	Manufacture’s Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 240 degree scale range	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
66	Marking	-	“BPDB & Contract No.”	
67	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.02 Guaranteed Technical Particulars of Substation Automation System (SAS)

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

SL No.	DESCRIPTION	UNIT	BPDB REQUIREMENT	BIDDER'S GUARANTEED VALUES
1	a) Manufacturer's name & address With website, official domain email.	-	Shall be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
2	Country of Origin	-	EU/USA/CANADA/ Japan/UK	
3	Model of the Substation Automation System	-	Shall be mentioned	
4	**General Requirement:**			
	Communication protocol at all levels (Standards to be complied with Substation Automation system)	-	IEC61850 Fully complying with the standard.	
	Temperature range (min/max)	-	0° to 50° C	
	Relative humidity	-	20 to 90 % non-condensing	
	Base of Station HMI	-	Active X	
	System performance and inter-operability test Among ABB, Siemens, Alstom, Schneider, NR and SEL IEDs done in the system verification center. (Supported by Test Report)	-	Yes	
	Control IEDs and protection IEDs are from same manufacturer	-	Yes	
	Intelligent Electronic Devices (IED's)			
	Manufacturer's name & address with official email address		Shall be mentioned	
	Type or Model		Shall be mentioned	
	Serial communication interface included		YES (IEC61850)	
	Protection & Control IED's connected to same bus		Yes	
	Self-monitoring		To be provided	
	Display of measured values		To be provided	
	Remote parameterization		To be provided	
	Disturbance record upload & analysis		To be provided	

	Availability Calculation shall be furnished for each equipment &as well as for the entire system		To be provided with Bid.	
	Number of years of proven field experience of offered system. (Note: Proof of experience should be furnished. The components used in the offered system and those with field experience should be the same)	-	5 Years	
	Engineering, Assembling and Wiring of Automation Panel/Cubicle shall be done from the origin of the manufacturer of the system	-	Yes	
	Dimensions of cubicle (Width x Depth x Height)	-	Shall be mentioned	
	Floor load	-	max. 600 N/m²	
	Design life of Substation Automation System	-	≥ 20 Years	
	Availability of the Spare parts of the system shall be ensured for duration of design life		Yes	
	Manufacturers quality assurance system	-	ISO 9001/9002 or equivalent	
5	**Station Level Equipment:**			
	Station Computer	-	Industrial PC	
	MTBF (Mean time between Failures)	Hrs	Shall be mentioned	
	MTTR (Mean time to repair)	Hrs	Shall be mentioned	
	Dual Station Computers Provided in redundant hot standby configuration	-	Yes	
	Hot standby takeover time	-	Seconds	
	Number of years of proven field experience of offered software	-	5 Yrs	
	Operating System	-	Windows	
	All standard picture as per technical specification included in HMI	-	To be provided	
	Process Status Display & Command Procedures	-	To be provided	
	Event processing as per technical specification	-	To be provided	
	Alarm processing as per technical specification	-	To be provided	
	Reports as per technical specification	-	To be provided	
	Trend Display as per technical specification	-	To be provided	
	User Authority levels as per spec	-	To be provided	
	System supervision & monitoring as per technical specification	-	To be provided	
	Automatic sequence control as per technical specification	-	To be provided	
	High quality SCD file complete with ICD files & station topology	-	To be provided	
	Operator Work Station (Master/Backup workstation) shall have separately connection to different Ethernet switch	-	Yes	
6	**Gateway to Central Control Room (2 nos.)**			

	Number of years of proven field experience of offered unit	Yrs	5 Yrs	
	Insulation tests	-	IEC60255-5	
	Fast disturbance tests	-	IEC 61000-4-4, Class 4	
	Industrial environment	-	EN 50081-2, Class A	
	Industrial grade hardware with no moving parts	-	To be provided	
	Design life of offered equipment	-	20Yrs	
	Communication channel with associates/peripherals (Main & redundant connection)	-	To be provided	
	CPU	-	To be provided	
	DC/DC Supply	-	To be provided	
	Redundant Power supply	-	To be provided	
	MTBF (Mean time between Failures)	-	Hrs	
	MTTR (Mean time to repair)	-	Hrs	
	The Master slave Licenses for SCADA and SAS communication in the gateway shall be activated	-	To be provided	
7	**Station Bus**:			
	Physical Medium connection with associates (Main & redundant communication)	-	Glass fiber optic with Flexible steel armoring	
8	**Inter bay Bus:**			
	Physical Medium connection with associates (Main & redundant communication)	-	Glass fiber optic with Flexible steel armoring	
9	**Printer Server**			
	MTBF	Hrs	Shall be mentioned	
11	**Hard Copy Color Printer**			
	MTBF	Hrs	Shall be mentioned	
12	**Master Clock – GPS (Global Positioning System) Receiver:**			
	Name of the manufacturer	-	Shall be mentioned	
	Manufacturer's address	-	Shall be mentioned	
	Model	-	Shall be mentioned	
	MTBF	Hrs	Shall be mentioned	
13	**Bay Control Unit-33 kV; Bay control function shall be provided in the O/C & E/F relay for each bay/feeder, which will be the part of GIS Panel. However, Separate Bay control unit beside O/C & E/F relay is also acceptable.**			
	Manufacturer's name & address	-	Shall be mentioned	
	Type or Model	-	Shall be mentioned	
	Country of Manufacture	-	Shall be mentioned	
	Number of years of proven field experience of offered unit	Yrs	5	

	Type of Bay controller offered	-	HV	
	Separate Bay control unit is provided for each bay & feeder or Bay Control function is provided in the O/C & E/F relay	-	Shall be mentioned	
	Single bit dependence	-	No	
	Control functionality implementation in software with Select before Operate provision for Open-Execute & Close-Execute, Interlocks and other necessary information	-	To be provided	
	Bay & Station Wide Synchro check function ❖ Maximum Voltage difference ❖ Maximum Frequency difference ❖ Maximum Phase difference	 Volt Hz Angle	 Specify range Specify range Specify range	
	Double command blocking	-	Yes	
	Independent settable parameter groups	-	To be provided	
	Local Display Unit	-	To be provided	
	Sequence of event recorder ❖ Events ❖ Time resolution	 Nos. ms	 Specify 1	
	Disturbance recorder function	-	To be provided	
	Comprehensive self-supervision	-	To be provided	
	Battery free backup of events and disturbance records	-	Yes	
	Insulation tests	-	IEC60255-5	
	Fast disturbance test	-	IEC61000-4-4,Class4	
	MTBF	Hrs	Shall be mentioned	
	MTTR	Hrs	Shall be mentioned	
	Temperature range: IED's ❖ Operation ❖ Transport and storage	 °C °C	 -10 to +50 -10 to +70	
	Relative humidity: ❖ Operating max./min ❖ Transport and storage	 % %	 93 93	
14	**Bay Control Unit-11 kV: Bay control function shall be provided in the O/C & E/F relay for each bay/feeder, which will be the part of GIS Panel. However, Separate Bay control unit besides O/C & E/F relay is also acceptable.**			
	Manufacturer's name & address	-	Shall be mentioned	
	Type or Model	-	Shall be mentioned	
	Country of Manufacture	-	Shall be mentioned	
	Number of years of proven field experience of offered unit	Yrs	5	
	Type of Bay controller offered	-	MV	
	Separate Bay control unit is provided for each bay & feeder or Bay Control function is provided in the O/C & E/F relay	-	Shall be mentioned	
	Single bit dependence	-	No	
	Control functionality implementation in software with	-	To be provided	

	Select before Operate provision for Open-Execute & Close-Execute, Interlocks and other necessary information			
	Bay & Station Wide Synchro check function ❖ Maximum Voltage difference ❖ Maximum Frequency difference ❖ Maximum Phase difference	 Volt Hz Angle	 Specify range Specify range Specify range	
	Double command blocking	-	Yes	
	Independent settable parameter groups	-	To be provided	
	Local Display Unit	-	To be provided	
	Sequence of event recorder ❖ Events ❖ Time resolution	 Nos. ms	 Specify 1	
	Disturbance recorder function	-	To be provided	
	Comprehensive self-supervision	-	To be provided	
	Battery free backup of events and disturbance records	-	Yes	
	Insulation tests	-	IEC60255-5	
	Fast disturbance test	-	IEC61000-4-4,Class4	
	MTBF	Hrs	Shall be mentioned	
	MTTR	Hrs	Shall be mentioned	
	Temperature range: IED's ❖ Operation ❖ Transport and storage	 °C °C	 -10 to +50 -10 to +70	
	Relative humidity: ❖ Operating max./min ❖ Transport and storage	 % %	 93 93	
15	**Ethernet Switch**			
	Name of manufacturer	-	Siemens/ ABB/ CISCO/ Schneider	
	Country		Shall be mentioned	
	Model number	-	Shall be mentioned	
	Type	-	Industrial Grade, rackable 19"-24 ports	
	Redundant Power supply	-	To be provided	
	Ethernet switch shall have dual connection to each other.	-	Yes	
16	**Operator Work Station (OWS)**			
	Brand	-	Any International reputed brand.	
	Model	-	To be mentioned	
	Type	-	Industrial PC (Panel mounted)	
	Country of Manufacture	-	To be mentioned	
	Processor	GHz	Intel core i7 8th	

			generation or latest	
	Clock Speed	GHz	3.0 GHz (min), 8 MB Cache Memory(min)	
	Bus Speed	MHz	Min. 1600 MHz	
	RAM	GB	8 GB, Expandable to 16 GB	
	HDD	GB	1 TB SSD	
	Mouse	-	Same Brand USB Scroll Optical Mouse	
	Keyboard	-	Same brand USB Keyboard	
	Monitor	inch	Same brand LED 24", 1920x1080, Full HD Monitor (Installed on monitoring table/desk)	
	OS Support	-	Windows 10 Professional or latest	
	OS	-	License windows with recovery kit	
	Software	-	Licensed Anti-Virus Software	
17	**Engineer Work Station (EWS)**			
	Brand	-	Any International reputed brand.	
	Model	-	To be mentioned	
	Type	-	Laptop having provision for to be locked (can be mounted on the SAS panel)	
	Country of Manufacture	-	To be mentioned	
	Processor	GHz	Intel Core i7 Processor, 8th generation or latest	
	Clock Speed	GHz	3.0 GHz (min), 8 MB L3 Cache Memory (min)	
	Bus Speed	MHz	Min. 1600 MHz	
	RAM	GB	(2x4 GB) 1 DIMM DDR4	
	HDD	GB	Min. 1 TB SSD	
	Mouse	-	Same Brand Wireless Scroll Optical Mouse	
	Keyboard	-	Integrated standard Keyboard	

	Monitor	inch	15.6", Full HD, True Life Display	
	Battery	-	6 cell lithium ion battery	
	Battery Backup	-	4 hours or higher with A/C Adapter	
	OS Support	-	Windows 10 professional or latest	
	OS	-	License windows with recovery kit	
	Software (To be installed & ready)	-	All types of configuration software with licenses for SAS, Licensed Anti-Virus Software, Licensed OS & other necessary software	
18	**Standard Color Printer**			
	Brand	-	Any International reputed brand.	
	Model	-	To be mentioned	
	Country of Manufacturer	-	To be mentioned	
	Toner type	-	Toner and associated drum unit in single case, No starter toner.	
	Resolution	dpi	1200 × 1200 dpi (Minimum)	
	Printing Speed	ppm	62-Page-per Minute (Letter), 35 PPM (A4) (min.)	
	First Page Print Out	second	As fast as 8 seconds	
	Memory	MB	256 MB (Minimum) Expandable to 1 GB	
	Trays	-	100 sheet multi-purpose input tray,2 x 500 sheet input tray 50-sheet face up output tray, 250-sheet face down output tray	
	Media Sizes	-	Letter, Legal, A4, A5, B5 and custom sizes	
	Media Types	-	Paper (Plain, Preprinted,	

			Letterhead, Bond, Color, Recycled, Rough),Transparencies, Labels	
19	**Firewall**			
	Name of Manufacturer		To be mentioned	
	Brand		To be mentioned	
	Model/Type		To be mentioned	
	Country of Origin (Place of Manufacturing)		To be mentioned	
	IP Filtering Port Filtering MAC Filtering URL Filtering Port Forwarding DMZ Denial of Service NAT Mapping		To be provided	
	Packet throughput of at least 150 Mbps		To be mentioned	
	3DES Encryption throughput of 20 Mbps		To be mentioned	
	Support for 200 VPNs		To be mentioned	
	Maximum concurrent sessions, with AVC		To be mentioned	
	Maximum new connections per second, with AVC		To be mentioned	
	Local On-device Management		Yes	
	Application Visibility and Control (AVC)		Standard	
	Security Intelligence		Standard, with IP, URL, and DNS threat intelligence	
	Redundant Power supply	-	To be provided	
20	**System Performance:**			
	- Exchange of display (First reaction) - Presentation of a binary change in the process display - Presentation of an analogue change in the process display - From order to process output - From order to updated of display	-	< 1 s < 0.5 s <1 s <0.5 s <1.5 s	
21	UPS with Panel (110 V DC from Substation main DC System Source will be interfaced)	-	01 set	
22	List (Name & version) of all types of			

	software required for SAS configuration, operation, monitoring and Remote control individually for Both OWS and EWS	-	To be mentioned	
23	Marking	**-**	"BPDB & Contract No."	
24	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.03 (a).Guaranteed Technical Particulars of 33 kV VCB (2500 Amps) for Dohazari Bay Extension.

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	Shall be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Manufacturer's model no.	-	To be mentioned	
3	Maximum Rated Voltage	KV	36	
4	Frequency	Hz	50	
5	Rated Normal current	A	**2500A**	
6	No. of phase	-	3	
7	No. of break per phrase	-	To be mentioned	
8	Interrupting medium	-	Vacuum	

9	Manufacturer's name and country of vacuum interrupter	-	To be mentioned	
10	Manufacturer's model no. of vacuum interrupter	-	To be mentioned	
11	Class of Circuit Breaker (Supported by Test Report from independent laboratory)	-	E2M2 or better	
12	Designation of Internal Arc Classification (Supported by Test Report from independent laboratory)	-	IAC AFLR 31.5 kA, 1 sec	
13	Impulse withstand on 1.2/50 μs wave	KV	170	
14	Power Frequency Test Voltage (Dry), at 50Hz, 1 min.	KV	70	
15	Short time withstand current, 3 second, rms	KA	40	
16	Breaking capacity: a) Symmetrical, rms b) Asymmetrical, rms	 KA KA	 40 As per IEC	
17	Short circuit making current, peak	KA	102	
18	First phase to clear factor	-	To be mentioned	
19	Rated transient recovery voltage at 100% rated short circuit breaking current	KVp	To be mentioned	
20	Rated line charging breaking current	A	To be mentioned	
21	Rated cable charging breaking current	A	To be mentioned	
22	Rated out of phase breaking current	A	To be mentioned	
23	Is circuit breaking restrike free?	Yes/No	Yes	
24	Trip coil current	A	To be mentioned	
25	Trip coil voltage	V, DC	110	
26	Is the circuit breaker trip free?	Yes/No	Yes	
27	Type of arc contacts or arc control Device	-	To be mentioned	
28	Main Contact : a) Type of contact b) Material of contract surfaces c) Contract resistance	 - - μΩ	 To be mentioned To be mentioned Less than 40	
29	Does magnetic effect of load Currents increase contact pressure?	Yes/ No	To be mentioned	
30	Length of each break/ phase	mm	To be mentioned	
31	Length of stroke	mm	To be mentioned	

32	Weight of circuit breaker unit complete, without operating mechanism and structure	Kg	To be mentioned	
33	Weight of circuit breaker complete with all fittings as in service.	Kg	To be mentioned	
34	Maximum shock load imposed on floor or foundation when opening under fault conditions (state compression or tension)	N	To be mentioned	
35	Maximum pressure rise in circuit Breaker due to making or breaking of Rated current in outer chamber	KN/m^2	To be mentioned	
36	Routine pressure test on circuit Breaker tanks or chamber	KN/m^2	To be mentioned	
37	Design pressure type test on circuit Breaker tanks or chamber	KN/m^2	To be mentioned	
	Operating Particulars :			
38	a) Opening time: without current at 100% of rated breaking current b) Breaking time c) Closing time	sec. Cycle ms	0.05 (maximum) **≤5** To be mentioned	
39	Maximum arc duration of any duty Cycle **as per latest revision of relevant IEC standard**	ms At…%	To be mentioned	
40	Current at which maximum arc duration occurs (critical current)	A	To be mentioned	
41	Make time	ms	To be mentioned	
42	Minimum time for arc extinction to Contract remark when adapted for auto re-closing	ms	To be mentioned	
43	Time from closing of control switch to completion of closing stroke during fault making	ms	To be mentioned	
	Constructional Features :			
44	Is an external series break Incorporated in the breaker?	Yes/ No	To be mentioned	
45	Is any device used to limit transient Recovery voltage?	Yes/ No	To be mentioned	
46	Method of closing	-	To be mentioned	
47	Method of tripping	-	To be mentioned	
48	Number of close/ trip operation possible on one spring charge	Nos.	To be mentioned	
49	Rated voltage of spring winding motor for closing	V.AC	230	

50	Spring winding motor current	A	To be mentioned	
51	Closing release coil current	A	To be mentioned	
52	Closing release coil voltage	V.DC	110	
53	Minimum clearance in air :			
	a) Between phase	mm	370	
	b) Phase to earth	mm	325	
	c) Across circuit breaker poles	mm	To be mentioned	
	d) Live conductor to ground level	mm	To be mentioned	
	e) Live insulator to ground level	mm	To be mentioned	
54	Material of tank or chamber	-	To be mentioned	
55	Material of moving contract tension rod	-	To be mentioned	
56	Period of time equipment has been in commercial operation	Year	To be mentioned	
57	No .of tripping coil	Nos.	2	
58	Circuit breaker terminal connectors	-	Copper	
59	Creepage distance (min)	mm/KV	25	
60	Method of indicating VCB ON/ OFF	Mech.& Elect.	To be mentioned	
61	Life of interrupter	Years	To be mentioned	
62	Pressure in vacuum tube for VCB	Bar	To be mentioned	
63	Guaranteed nos. of operation for vacuum Interrupter :			
	a) at rated Current switching (Supported by Test Report from independent laboratory)	Nos.	**10,000**	
	b) at Short circuit current switching	Nos.	≥ 50	
64	Rated operating sequence	-	O-0.3sec-CO-3m-CO	

65	All current carrying parts of VCB Shall be made of	-	Copper	
66	Standard	-	**IEC-60056/ IEC-62271-100**	
67	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.03 (b). Guaranteed Technical Particulars of 33 kV VCB (1600 Amps) for Shikolbaha & Chokoria bay Extension.

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Manufacturer's model no.	-	To be mentioned	
3	Maximum Rated Voltage	KV	36	
4	Frequency	Hz	50	
5	Rated Normal current	A	**1600A**	
6	No. of phase	-	3	

7	No. of break per phrase	-	To be mentioned	
8	Interrupting medium	-	Vacuum	
9	Manufacturer's name and country of vacuum interrupter	-	To be mentioned	
10	Manufacturer's model no. of vacuum interrupter	-	To be mentioned	
11	Class of Circuit Breaker (Supported by Test Report from independent laboratory)	-	E2M2 or better	
12	Designation of Internal Arc Classification (Supported by Test Report from independent laboratory)	-	IAC AFLR 31.5 kA, 1 sec	
13	Impulse withstand on 1.2/50 μs wave	KV	170	
14	Power Frequency Test Voltage (Dry), at 50Hz, 1 min.	KV	70	
15	Short time withstand current, 3 second, rms	KA	31.5	
16	Breaking capacity: a) Symmetrical, rms b) Asymmetrical, rms	 KA KA	 31.5 As per IEC	
17	Short circuit making current, peak	KA	80	
18	First phase to clear factor	-	To be mentioned	
19	Rated transient recovery voltage at 100% rated short circuit breaking current	KVp	To be mentioned	
20	Rated line charging breaking current	A	To be mentioned	
21	Rated cable charging breaking current	A	To be mentioned	
22	Rated out of phase breaking current	A	To be mentioned	
23	Is circuit breaking restrike free?	Yes/No	Yes	
24	Trip coil current	A	To be mentioned	
25	Trip coil voltage	V, DC	110	
26	Is the circuit breaker trip free?	Yes/No	Yes	
27	Type of arc contacts or arc control Device	-	To be mentioned	
28	Main Contact : a) Type of contact b) Material of contract surfaces c) Contract resistance	 - - μΩ	 To be mentioned To be mentioned Less than 40	
29	Does magnetic effect of load Currents increase contact pressure?	Yes/ No	To be mentioned	
30	Length of each break/ phase	mm	To be mentioned	

31	Length of stroke	mm	To be mentioned	
32	Weight of circuit breaker unit complete, without operating mechanism and structure	Kg	To be mentioned	
33	Weight of circuit breaker complete with all fittings as in service.	Kg	To be mentioned	
34	Maximum shock load imposed on floor or foundation when opening under fault conditions (state compression or tension)	N	To be mentioned	
35	Maximum pressure rise in circuit Breaker due to making or breaking of Rated current in outer chamber	KN/m^2	To be mentioned	
36	Routine pressure test on circuit Breaker tanks or chamber	KN/m^2	To be mentioned	
37	Design pressure type test on circuit Breaker tanks or chamber	KN/m^2	To be mentioned	
	Operating Particulars :			
38	a) Opening time: without current at 100% of rated breaking current b) Breaking time c) Closing time	sec. Cycle ms	0.05 (maximum) ≤5 To be mentioned	
39	Maximum arc duration of any duty Cycle **as per latest revision of relevant IEC standard**	ms At…%	To be mentioned	
40	Current at which maximum arc duration occurs (critical current)	A	To be mentioned	
41	Make time	ms	To be mentioned	
42	Minimum time for arc extinction to Contract remark when adapted for auto re-closing	ms	To be mentioned	
43	Time from closing of control switch to completion of closing stroke during fault making	ms	To be mentioned	
Constructional Features :				
44	Is an external series break Incorporated in the breaker?	Yes/ No	To be mentioned	
45	Is any device used to limit transient Recovery voltage?	Yes/ No	To be mentioned	
46	Method of closing	-	To be mentioned	
47	Method of tripping	-	To be mentioned	
48	Number of close/ trip operation possible on one spring charge	Nos.	To be mentioned	
49	Rated voltage of spring winding motor for	V.AC	230	

	closing			
50	Spring winding motor current	A	To be mentioned	
51	Closing release coil current	A	To be mentioned	
52	Closing release coil voltage	V.DC	110	
53	Minimum clearance in air :			
	a) Between phase	mm	370	
	b) Phase to earth	mm	325	
	c) Across circuit breaker poles	mm	To be mentioned	
	d) Live conductor to ground level	mm	To be mentioned	
	e) Live insulator to ground level	mm	To be mentioned	
54	Material of tank or chamber	-	To be mentioned	
55	Material of moving contract tension rod	-	To be mentioned	
56	Period of time equipment has been in commercial operation	Year	To be mentioned	
57	No .of tripping coil	Nos.	2	
58	Circuit breaker terminal connectors	-	Copper	
59	Creepage distance (min)	mm/KV	25	
60	Method of indicating VCB ON/ OFF	Mech.& Elect.	To be mentioned	
61	Life of interrupter	Years	To be mentioned	
62	Pressure in vacuum tube for VCB	Bar	To be mentioned	
63	Guaranteed nos. of operation for vacuum Interrupter :			
	a) at rated Current switching (Supported by Test Report from independent laboratory)	Nos.	**10,000**	
	b) at Short circuit current switching	Nos.	≥ 50	
64	Rated operating sequence	-	O-0.3sec-	

			CO-3m-CO	
65	All current carrying parts of VCB Shall be made of	-	Copper	
66	Standard	-	**IEC-60056/ IEC-62271-100**	
67	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.04. Guaranteed Technical Particulars for 33 KV Protection Control and Metering Panel

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl No	Description	Unit	BPDB's Requirement	Bidders Guaranteed value
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Manufacturer's Model no.	-	To be mentioned	
3.	System nominal voltage	kV	33	
4.	Maximum System Voltage	kV	36	
5.	Rated Frequency	Hz	50	

A. Protection Control & Metering (Transformer Feeder) Not Applicable				
6.	**Differential Relay**			
	Manufacturer's Name	-	ABB- (Sweden/ Switzerland/ Finland)/ Siemens-(Germany)/ Alstom-(France/UK)/ Schneider-(France/UK)/ NR, China/ SEL, USA	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable	
	Maximum through fault at which the protective equipment is stable with recommend settings:			
	a) Earth faults	rating % of CT rating	Shall be mentioned	
	b) Phase faults		Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	ms	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
7.	**Restricted Earth Fault Relay (in built function of differential relay)**			
	Manufacture's Name & Country of Origin	-	ABB- (Sweden/ Switzerland/Finland)/ Siemens-(Germany)/ Alstom-(France/UK)/ Schneider-(France/UK)/ NR - China/ SEL- USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Numerical programmable	
	Range of current setting:	-	Shall be mentioned	
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Earth fault element		Shall be mentioned	
	Earth fault element Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	Percentage of current setting at which relay will reset.	%	Shall be mentioned	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
8	**Over Current & Earth Fault Protection Relay**			
	Manufacture's Name Country of Origin	-	ABB- (Sweden/Switzerland/ Finland)/ Siemens(Germany)/ Alstom-(France/UK)/	

			Schneider-(France/UK) / NR, China/ SEL, USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable Multifunction	
	The Relay shall be IEC 61850 protocol type.	-	Yes	
	Range of current setting :			
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Earth fault element		Shall be mentioned	
	Range of timing settings at 10 time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10 time CT rating	VA	Shall be mentioned	
	Percentage of current at which relay will reset	%	Shall be mentioned	
	Reset time after removal of 10 times CT rated current	Sec	Shall be mentioned	
9	**Separate Auxiliary Flag Relays for Transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank & OLTC).**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no	-	Shall be mentioned	
	Type of Relays	-	Shall be mentioned	
10	**Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
11	**Trip Relay (Separate Relay) for Differential and O/C & E/F**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Hand & Electrical reset type for Differential, REF and Transformer Self-protection	-	Yes	
	Operating coil voltage 110V DC	-	Yes	
12	**Annunciator**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	30 or More.	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC/DC Dual Supply Provision	-	Yes	
13	**Control Switch**			

	Manufacture's Name& Country	-	Shall be mentioned	
	Manufacture's Model/Type No.	-	Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
B. Protection Control & Metering (Line Feeder)				
15	**Over Current & Earth Fault Protection Relay with Directional feature**			
	Manufacture's Name Country of Origin	-	ABB-(Sweden/Switzerland/ Finland)/Siemens-(Germany)/ Alstom-(France/UK)/ Schneider-(France/UK)/ NR, China/ SEL, USA	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of relay	-	Numerical, programmable, multifunction with both directional and non-directional O/C & E/F protection (IDMT, DMT, Inst.) feature and monitoring functions.	
	Directional Feature can be activated/de-activated	Yes/No	Yes	
	The relay shall have IEC 61850 communication Protocol.	-	Yes	
	Range of current setting :			
	a) Phase element	% of CT rating	Shall be mentioned	
	b) Earth fault element		Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	24 for line Feeder, 32 for Bus Coupler	
	No of Binary Output (Minimum)	-	24 for line Feeder, 24 for Bus Coupler	
	No of Communication Ports xv) Electrical xvi) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Directional and Non-Directional O/C, E/F, Over/ Under Voltage, Over and Under Frequency, Sync Check And Other Necessary Functions.	

	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Drop off to Pick up ratio	-	Shall be mentioned	
	Reset time after removal of fault current	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Percentage of Current setting at which relay will reset	%	Shall be mentioned	
	Reset time after removal of 10 time CT rated current for: a) Phase element (100%) b) E/F element (40%)	 Sec Sec	Shall be mentioned	
16	**Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Relay	-	Shall be mentioned	
17	**Trip Relay (Separate Relay)**			
	Manufacture's Name	-	Shall be mentioned	
	Country of Origin	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Operating Time	ms	<10	
	Self-reset type for O/C, E/F protection	-	Yes	
	Operating coil voltage 110V DC	-	Yes	
18	**Annunciator**			
	Manufacture's Name& Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Windows	nos.	14	
	Built in buzzer and buttons for accept, mute, test, reset, etc.	-	Yes	
	AC/DC Dual Supply Provision	-	Yes	
19	**Control Switch**			
	Manufacture's Name& Country	-	Shall be mentioned	
	Manufacture's Model/Type No.	-	Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch	-	Yes	
20	**Metering and Instrumentation**			
20.1	**Energy Meter (Multi Tariff Programmable**			

	Meter)			
	Manufacture's Name	-	Shall be mentioned	
	Manufacture's Country		European Country/ North American Country/ Japan/ Australia	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Numerical programmable Multifunction	
	Class of Accuracy	-	0.2S	
20.2	**Volt Meters with Selector Switch**			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 90 degree scale range	
	Class of Accuracy	-	1.0	
20.3	**AMPERE METERS**			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of Meter	-	Analogue, 240 degree scale range	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
21	Marking	-	"BPDB & Contract No."	
22	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.05 Guaranteed technical particulars of 110v 3x5(6)A, 3-phase, 4-wire, 3-element, solid state indoor type multi tariff programmable meter

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Required Specification	Manufacture's particulars
1	Reference Standard	-	Relevant ANSI / IEC Standard	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Manufacturer's type & model	-	Shall be mentioned	
4	Construction/connection	-	3-Phase 4-wire solidly grounded neutral	
5	Installation	-	Indoor installation in A socket [for socket type]	
6	Number of element	-	3 (Three)	
7	Rated Voltage	Volt	110V	
8	Minimum Biasing Voltage	Volt	40V	
9	Variation of Frequency	%	± 2%	
10	Variation of Voltage	%	+ 10, -20%	
11	Accuracy class		Accuracy class: 0.2s (point two S)	
12	Rated Current			
	i) Nominal Current	A	= 5	
	ii) Maximum Current	A	≥ 6	
13	Resister Type		LCD Display	
14	Number of Digits (Integer with Decimal)	Nos.	8 with 3 (Programmable)	
15	Starting Current	ma	0.1% of Nominal Current	
16	Losses at Nominal Load	Watt	Shall be mentioned	
17	Meter Constant	Imp./	Shall be mentioned	
18	Integration Period	-	30 (Thirty) Minutes	
	Resetting Period	-	1 (one) month	
	Cumulative MD transfer	-	Built in	
	Cycle Timing Device	-	Built in	
19	Size of the Digit of Display	E x H in mm	4 x 8	
20	No. of Terminal	Nos.	10 (Ten) min	

21	Type of socket and country of origin		-	To be mentioned	
22	Battery Service life and shelf Life (minimum)		Year	10 (ten) & 15 (fifteen)	
23	Year of manufacture			Shall be mentioned	
24	List of Recommended spare parts (if any)		any	Shall be mentioned	
25	Warranty		Year	3 (three)	
26	Meter Service Life (Min)		Year	15 (fifteen)	
27	Weight of meter		Kg	Shall be mentioned	
28	Dimensions		mm x mm x mm	Shall be mentioned	
29	Outlines, Drawings & Leaflets			Shall be mentioned	
30	Performance Curve for Balanced & Unbalanced load			Shall be mentioned	
31	Meter sealing condition			Hermetically or Ultrasonic welded	
32	a) Country of Origin b) Place of Manufacture c) Place of Testing			Shall be mentioned	
33	Memory Storage			Shall be mentioned by putting Yes/ No.	
	i)	Equipment Identification Code			
	ii)	Security code			
	iii)	Access code			
	iv)	Number of Power Interruption with Date & Time			
	V	Latest Power Failure- Time & Date			
	Vi	Event logs			
	vii)	Cumulative kWh, kVarh (Q_1 + Q_4) Reading for previous two months			
	viii) Load profile with 30 min interval at least 90 days for:				
		KWh, kVarh (Q_1+Q_4)			
		Phase Voltage or Vh			

		Phase Amps or Ah			

	Metering and Indication			
34.	**KWh Meter**			
34.1	Manufacture's Country	-	European Country/ North American Country/Japan/ Australia	
34.2	Manufacture's Model no.	-	To be mentioned	
34.3	Type of meter	-	Numerical programmable multifunction	
34.4	Class of accuracy	-	0.2S	
35	**Indication Volt Meters**			
35.1	Manufacturer's Name and Country	-	To be mentioned	
35.2	Manufacture's Model no.	-	To be mentioned	
35.3	Type of meter	-	Analogue	
35.4	Class of Accuracy	-	To be mentioned	
36	**Indication Ampere Meters**			
36.1	Manufacturer's Name and Country	-	To be mentioned	
36.2	Manufacture's Model no.	-	To be mentioned	
36.3	Type of meter	-	Analogue, 240° Scale Range	
36.4	Class of Accuracy	-	To be mentioned	
36.5	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.06 (a).Guaranteed Technical Particulars of 33kV Off-Load Isolator with Earth Blade

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, Otherwise bid shall be rejected. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer' s Guaranteed Particulars
General Description of Disconnecting Switch				
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Frequency	Hz	50	
4.	System Nominal Voltage	kV	33	
5.	System Maximum Voltage	kV	36	
6.	Basic Insulation Level	kV	170	
7.	Rated Normal Current	A	2500	
8.	Power Frequency Withstand Voltage (for 1 min)	kV	70	
9.	Rated short time withstands current (for 3sec.)	kA	31.5	
10.	Installation	-	Outdoor	
11.	Type	-	Single Vertical Break	
12.	Construction	-	Open	
13.	Mounting Position	-	Vertical	
14.	Number of Pole	nos.	3 (Three)	
15.	No. of break per pole	nos.	One	
16.	Air gap between pole of phase	mm	1000	
17.	Insulator Material	-	Porcelain	
18.	Creepage distance of Insulator	mm/KV	25	
19.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
20.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
Contacts:				
21.	Materials of the current carrying path		Copper with Nickel Plating	
22.	Contract Resistance for DS & ES	μΩ	Less than 50	
23.	**Contact Area:**			

23.1	Moving Blade for DS	mm^2	10x60 mm copper flat bar, length 750±20 mm -02 Nos per phase	
23.2	Moving Blade for ES	mm^2	10x60 mm copper flat bar, length 500±15 mm -02 Nos per phase	
23.3	Terminal Pad	mm^2	12x100 mm Copper flat bar -02 Nos per phase	
24.	Contact type		Spring loaded contact	
25.	Operation	-	Gang	
26.	Type of main DS operating mechanism	-	Manual	
27.	Number of main DS operating mechanism per set	Nos	1	
28.	Type of Earth Switch operating mechanism	-	Manual	
29.	Number of Earth Switch operating mechanism per set	Nos	1	
30.	Nos. of Auxiliary Contracts (NO/NC) For Isolator& Earth Switch	-	Isolator- 4NO-4NC Earth switch – 4NO-4NC	
31.	Locking facility in the operating box in both close and open position	-	Yes	
32.	Mechanical Interlocking facility between main DS and ES	-	Yes	
33.	**Operating GI Pipe Dimensions:**	-		
33.1	For main DS	-	OD- 44 mm, ID – 36 mm, Length – 6 meter	
33.2	For Earth Switch	-	OD- 44 mm, ID – 36 mm, Length – 6 meter	
34.	**MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized)**	-		
34.1	For main DS	-	To be mentioned	
34.2	For Earth Switch	-	To be mentioned	
35.	Total weight of Isolator	Kg	To be mentioned	
36.	Total weight of earth switch	Kg	To be mentioned	
37.	Total weight of Unit	Kg	To be mentioned	
38.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be submitted	
39.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	
40.	Standard		IEC-62271-102	

41.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer Seal & Signature of the Bidder

8.06 (b).Guaranteed Technical Particulars of 33kV Off-Load Isolator with Earth Blade

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, Otherwise bid shall be rejected. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer' s Guaranteed Particulars
General Description of Disconnecting Switch				
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Frequency	Hz	50	
4.	System Nominal Voltage	kV	33	
5.	System Maximum Voltage	kV	36	
6.	Basic Insulation Level	kV	170	
7.	Rated Normal Current	A	1600	
8.	Power Frequency Withstand Voltage (for 1 min)	kV	70	
9.	Rated short time withstand current (for 3sec.)	kA	31.5	
10.	Installation	-	Outdoor	
11.	Type	-	Single Vertical Break	
12.	Construction	-	Open	
13.	Mounting Position	-	Vertical	
14.	Number of Pole	nos.	3 (Three)	
15.	No. of break per pole	nos.	One	
16.	Air gap between pole of phase	mm	1000	
17.	Insulator Material	-	Porcelain	
18.	Creepage distance of Insulator	mm/KV	25	

19.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
20.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
Contacts:				
21.	Materials of the current carrying path		Copper with Nickel Plating	
22.	Contract Resistance for DS & ES	μΩ	Less than 50	
23.	**Contact Area:**			
23.1	Moving Blade for DS	mm^2	6x70 mm copper flat bar, length 750±20 mm -02 Nos per phase	
23.2	Moving Blade for ES	mm^2	6x70 mm copper flat bar, length 500±15 mm -02 Nos per phase	
23.3	Terminal Pad	mm^2	12x60 mm Copper flat bar -02 Nos per phase	
24.	Contact type		Spring loaded contact	
25.	Operation	-	Gang	
26.	Type of main DS operating mechanism	-	Manual	
27.	Number of main DS operating mechanism per set	Nos	1	
28.	Type of Earth Switch operating mechanism	-	Manual	
29.	Number of Earth Switch operating mechanism per set	Nos	1	
30.	Nos. of Auxiliary Contracts (NO/NC) For Isolator& Earth Switch	-	Isolator- 4NO-4NC Earth switch – 4NO-4NC	
31.	Locking facility in the operating box in both close and open position	-	Yes	
32.	Mechanical Interlocking facility between main DS and ES	-	Yes	
33.	**Operating GI Pipe Dimensions:**	-		
33.1	For main DS	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	
33.2	For Earth Switch	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	
34.	**MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized)**	-		
34.1	For main DS	-	To be mentioned	

34.2	For Earth Switch	-	To be mentioned	
35.	Total weight of Isolator	Kg	To be mentioned	
36.	Total weight of earth switch	Kg	To be mentioned	
37.	Total weight of Unit	Kg	To be mentioned	
38.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be submitted	
39.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	
40.	Standard		IEC-62271-102	
41.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer Seal & Signature of the Bidder

8.07 (a).Guaranteed Technical Particulars of 33 kV Off-Load Isolator without Earth Blade

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	**Description**	**Unit**	**BPDB's Requirement**	**Manufacturer' s Guaranteed Particulars**
General Description of Disconnecting Switch				
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Frequency	Hz	50	

4.	System Nominal Voltage	kV	33	
5.	System Maximum Voltage	kV	36	
6.	Basic Insulation Level	kV	170	
7.	Rated Normal Current	A	2500	
8.	Power Frequency Withstand Voltage (for 1 min)	kV	70	
9.	Rated short time withstand current (for 3sec.)	kA	31.5	
10.	Installation	-	Outdoor	
11.	Type	-	Single Vertical Break	
12.	a) Construction	-	Open	
	b) Mechanical Endurance Class	-	M1 (Minimum)	
13.	Mounting Position	-	Vertical	
14.	Number of Pole	nos.	3 (Three)	
15.	No. of break per pole	nos.	One	
16.	Air gap between pole of phase	mm	1000	
17.	Insulator Material	-	Porcelain	
18.	Creepage distance of Insulator	mm	To be mentioned	
19.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
20.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
Contacts:				
21.	Materials of the current carrying path		Copper with Nickel Plating	
22.	Contract Resistance	μΩ	Less than 50 μΩ	
23.				

23.1	Moving Blade	mm^2	10x60 mm copper flat bar, length 750±20 mm -02 Nos per phase	
23.2	Terminal Pad	mm^2	12x100 mm Copper flat bar -02 Nos per phase	
24.	Contact type		Spring loaded contact	
25.	Operation	-	Gang	
26.	Type of main DS operating mechanism	-	Manual	
27.	Number of main DS operating mechanism per set	Nos	1	
28.	Nos. of Auxiliary Contracts (NO/NC) For Isolator	-	Isolator- 4NO-4NC	
29.	Locking facility in the operating box in both and open position	-	Yes	
30.	**Operating GI Pipe Dimensions :**	-		
	For main DS	-	OD- 44 mm, ID – 36 mm, Length – 6 meter	
31.	**MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized):**	-		
	For main DS	-	To be mentioned	
32.	Total weight of Isolator	Kg	To be mentioned	
33.	Total weight of Unit	Kg	To be mentioned	
34.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be submitted	
35.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	

36.	Standard		IEC-62271-102	
37.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer	**Seal & Signature of the Bidder**

8.07 (b).Guaranteed Technical Particulars of 33 kV Off-Load Isolator without Earth Blade

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer' s Guaranteed Particulars
General Description of Disconnecting Switch				
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Frequency	Hz	50	
4.	System Nominal Voltage	kV	33	
5.	System Maximum Voltage	kV	36	
6.	Basic Insulation Level	kV	170	
7.	Rated Normal Current	A	1600	
8.	Power Frequency Withstand Voltage (for 1 min)	kV	70	
9.	Rated short time withstand current (for 3sec.)	kA	31.5	
10.	Installation	-	Outdoor	
11.	Type	-	Single Vertical Break	
12.	a) Construction	-	Open	
	b) Mechanical Endurance Class	-	M1 (Minimum)	
13.	Mounting Position	-	Vertical	
14.	Number of Pole	nos.	3 (Three)	
15.	No. of break per pole	nos.	One	
16.	Air gap between pole of phase	mm	1000	

17.	Insulator Material	-	Porcelain	
18.	Creepage distance of Insulator	mm	To be mentioned	
19.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
20.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
Contacts:				
21.	Materials of the current carrying path		Copper with Nickel Plating	
22.	Contract Resistance	μΩ	Less than 50 μΩ	
23.				
23.1	Moving Blade	mm^2	6x70 mm copper flat bar, length 750±20 mm -02 Nos per phase	
23.2	Terminal Pad	mm^2	12x60 mm Copper flat bar -02 Nos per phase	
24.	Contact type		Spring loaded contact	
25.	Operation	-	Gang	
26.	Type of main DS operating mechanism	-	Manual	
27.	Number of main DS operating mechanism per set	Nos	1	
28.	Nos. of Auxiliary Contracts (NO/NC) For Isolator	-	Isolator- 4NO-4NC	
29.	Locking facility in the operating box in both and open position	-	Yes	
30.	**Operating GI Pipe Dimensions :**	-		

	For main DS	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	
31.	**MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized):**	-		
	For main DS	-	To be mentioned	
32.	Total weight of Isolator	Kg	To be mentioned	
33.	Total weight of Unit	Kg	To be mentioned	
34.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be submitted	
35.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	
36.	Standard		IEC-62271-102	
37.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.0 GUARANTEED TECHNICAL PARTICULARS OF 33 KV OFF-LOAD FUSED ISOLATOR FOR BUS PT

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer' s guaranteed Particulars
	General Description of Disconnecting Switch			
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Application of the Disconnecting Switch		For BUS PT	
3.	Manufacturer's Model designation	-	To be mentioned	
4.	Frequency	Hz	50	
5.	System Nominal Voltage	kV	33	
6.	System Maximum Voltage	kV	36	
7.	Basic Insulation Level	kV	170	
8.	Rated Normal Current	A	400	
9.	Power Frequency Withstand Voltage (for 1 min)	kV	70	
10.	Rated short time withstand current (for 3sec.)	kA	25	
11.	Installation	-	Outdoor	
12.	Type	-	Single Vertical Break Offload Fused Isolator	
13.	Construction	-	Open	
14.	Mounting Position	-	Vertical	

15.	Number of Pole	nos.	3 (Three)	
16.	No. of break per pole	nos.	One	
17.	Air gap between pole of phase	mm	1000	
18.	Insulator Material	-	Porcelain	
19.	Creepage distance of Insulator	mm	To be mentioned	
20.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
21.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
Contacts				
22.	Materials of the current carrying path		Copper with Nickel Plating	
23.	Contract Resistance		Less than 50 μΩ	
24.	Contact Area			
24.1	Moving Blade	mm^2	5x30 mm copper flat bar, length 810±20 2 Nos per phase	
24.2	Terminal Pad	mm^2	6x40 mm Copper bar flat 2 Nos per phase	
25.	Contact type		Spring loaded contact	
Operating Mechanism				
26.	Operation	-	Gang	
27.	Type of main DS operating mechanism	-	Manual	
28.	Number of main DS operating mechanism per set	Nos	1	

29.	Nos. of Auxiliary Contracts (NO/NC) For Isolator	-	Isolator- 4NO-4NC	
30.	Locking facility in the operating box in both and open position		Yes	
31.	Operating GI Pipe Dimensions			
	For main DS		OD- 42 mm, ID – 36 mm, Length – 6 meter	
32.	MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized)			
33.	For main DS		32x32x3600 mm	
34.	Total weight of Unit	Kg	To be mentioned	
Fuse Description				
35.	Rated Fuse Voltage	kV	33	
36.	Fuse type	-	Drop Out Fuse Barrel with Link	
37.	Rated fuse link normal current	A	1 -2 Amperes	
38.	Rated fuse link interrupting current	kA	31.5 kA, RMS Symmetrical	
39.	Fuse link type	No	Two element, slow/fast unit	
40.	Fuse holder type	-	Heavy duty, sealed cap with eye at both ends of fuse holder	
41.	Fuse link co-ordination	-	Shall co-ordinate with existing system protective equipment	
42.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be mentioned	
43.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	
44.	Standard		IEC-62271-102	
45.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.9. (a) Guaranteed Technical Particulars of 33 kV outdoor type single phase current Transformer for Dohazari Bay Extension.

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Manufacturer's Model No.	-	To be mentioned	
3	Application	-	Metering and Protection	
4	Type	-	Induction	
5	Installation	-	Outdoor	
6	Construction	-	Sealed Tank	
7	Insulation	-	Oil	
8	Number of Phase	-	Single	
9	Rated Frequency	Hz	50	
10	Mounting	-	On Supporting Structure	
11	Primary rated voltage (Phase to Phase)	kV	33	
12	Maximum System Voltage (Phase to Phase)	kV	36	
13	System Earthing	-	Effectively Earthed	
14	Basic Insulation Level (1.2/50 Micro-Sec.)	kV	170	
15	Power frequency withstand voltage (1 Min. 50 Hz.)	kV	70	
16	**Ratio for 33KV Line feeder:**	A	1200-2400/5-5A	
17	Type of Winding:			
	a) Primary	-	Single Winding	
	b) Secondary	-	Double (1 protection & 1 measuring)/Triple winding (2 protection & 1 measuring)	
18	Accuracy Class:			
	a) for measurement	-	0.2 S	
	b) for Protection	-	5P20	
19	R_{CT} at 75^0C:			
	a) measuring core	mΩ	To be mentioned	
	b) protection core	mΩ	To be mentioned	
20	Knee point voltage (Supported by Calculation)			

	For Measuring Core	V	To be mentioned	
	For Protection Core	V	To be mentioned	
21	Burden:			
	a) for measurement	VA	30	
	b) for Protection	VA	30	
22	Short Time Current Rating for 3 Sec.	kA	31.5	
23	Extended Current Rating (% of rated current)	%	120	
24	Over Current Rating	A	<10	
25	Creepage Distance	mm/kV (Min.)	25	
26	Rated accuracy limit factor	-	20	
27	Bushing	-	Porcelain outdoor type	
28	Standard	-	IEC 61869-1 & IEC 61869-2	
29	CT Burden shall meet the short circuit current (31.5 kA, 3 Sec)	-	Yes	
30	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal & Signature
of the Manufacturer

Seal & Signature
of the Bidder

8.9.(b)Guaranteed Technical Particulars of 33 kV outdoor type single phase current Transformer for (shikolbaha & Chokoria Bay Extension).

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Manufacturer's Model No.	-	To be mentioned	
3	Application	-	Metering and Protection	
4	Type	-	Induction	
5	Installation	-	Outdoor	
6	Construction	-	Sealed Tank	
7	Insulation	-	Oil	
8	Number of Phase	-	Single	
9	Rated Frequency	Hz	50	
10	Mounting	-	On Supporting Structure	
11	Primary rated voltage (Phase to Phase)	kV	33	
12	Maximum System Voltage (Phase to Phase)	kV	36	
13	System Earthing	-	Effectively Earthed	
14	Basic Insulation Level (1.2/50 Micro-Sec.)	kV	170	
15	Power frequency withstand voltage (1 Min. 50 Hz.)	kV	70	
16	**Ratio for 33KV Line feeder:**	A	600-1200/5-5A	
17	Type of Winding:			
	a) Primary	-	Single Winding	
	b) Secondary	-	Double (1 protection & 1 measuring)/Triple winding (2 protection & 1 measuring)	
18	Accuracy Class:			
	a) for measurement	-	0.2 S	
	b) for Protection	-	5P20	
19	R_{CT} at 75^0C:			
	a) measuring core	mΩ	To be mentioned	
	b) protection core	mΩ	To be mentioned	
20	Knee point voltage (Supported by Calculation)			
	For Measuring Core	V	To be mentioned	
	For Protection Core	V	To be mentioned	
21	Burden:			
	a) for measurement	VA	30	
	b) for Protection	VA	30	
22	Short Time Current Rating for 3 Sec.	kA	31.5	
23	Extended Current Rating (% of rated current)	%	120	
24	Over Current Rating	A	<10	
25	Creepage Distance	mm/kV		

		(Min.)	25	
26	Rated accuracy limit factor	-	20	
27	Bushing	-	Porcelain outdoor type	
28	Standard	-	IEC 61869-1 & IEC 61869-2	
29	CT Burden shall meet the short circuit current (31.5 kA, 3 Sec)	-	Yes	
30	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal & Signature
of the Manufacturer

Seal & Signature
of the Bidder

8.10 Guaranteed Technical Particulars of 33 kV Outdoor Type Single Phase Potential Transformer

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Manufacturer's Model No.	-	To be mentioned	
3	Type	-	Induction Type	
4	Ratio	V	33000/√3:110/√3:110/√3	
5	No. of phase	Nos.	Single Phase	
6	Total capacitance at 100 Hz	PF	To be mentioned	
7	50 Hz 1 (One) minute withstand voltage wet	KV	To be mentioned	
8	Impulse withstand (1.2/50 micro sec. wave)	KV	170	
9	Rated burden per phase	VA	30VA	
10	Class of accuracy	-	0.2+3P	
11	Temperature co-efficient of ratio per ^{0}C	-	To be mentioned	
12	System earthing	-	Effectively Earthed	
13	Creepage Distance	mm/kV	25 (min)	
14	Maximum errors with 5% primary voltage:			
	a) Ratio	%	To be mentioned	
	b) Phase angle	minutes	To be mentioned	
15	Total weight complete	Kg	To be mentioned	
16	Standard	-	IEC 61869-1 & IEC 61869-3	
17	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.11 Guaranteed Technical Particulars of 33KV Single Phase Lightning Arrester

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
01	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
02	Country of Origin		To be mentioned	
03	Place of manufacture		To be mentioned.	
04	Manufacturer's model No.	-	To be mentioned	
05	Type of the Arrester	-	Metal Oxide (ZnO), Gapless-Outdoor (Single Unit,)	
06	Rated Arrester Voltage	kV	36	
07	Continuous Operating Voltage (COV, Uc)	kV	22- 27.5	
08	Nominal Discharge Current (8/20micro sec)	KA	10	
09	Type of Lightning Arrester housing	-	Porcelain/polymer (Hydrophobic silicon)	
10	Power Frequency withstand voltage of the Arrester Housing, Dry & Wet	kV rms	70 (Dry) & 70 (Wet)	
11	Impulse withstand Voltage of the Arrester Housing.	kV (peak)	170	
12	Lightning Impulse Residual Voltage (8/20 micro-second wave)	kV (peak)	80 or better	
13	Maxm. Steep Current Impulse Residual Voltage at 10 KA of 1 micro second front time.	kV (peak)	85 or better	
14	High Current Impulse Withstand Value (4/10 micro second)	KA	100 or better	
15	Temporary Over voltage capability**:**			
16	a) 0.1 Second	kV (peak)	Shall be mentioned	
	b) 1.0 Second	kV (peak)	Shall be mentioned	
	c) 10 Second	kV (peak)	Shall be mentioned	
	d) 100 Second	kV (peak)	Shall be mentioned	
	Leakage Current at rated voltage	mA	< 1 mA	
17	**Total Creepage distance (minimum)**	mm/ kV	31	
18	Overall dimension **:**			
19	a) Height	mm	Shall be mentioned	
	b) Diameter	mm	Shall be mentioned	
	Total weight of Arrester	Kg.	Shall be mentioned	
20	Line discharge class	-	Shall be mentioned	
21	Short Circuit Current Withstand duration	Sec	31.5kA, 1 sec	

22	Minimum Energy Discharge capability (KJ/KV) at rated voltage	-	5	
23	Min. Bending load (kgm)		500	
24	Surge Counter /Monitor		Shall be provided	
25	Cable for Connecting Surge Counter		Shall be provided	
26	Reference Standard		IEC 60099-4	
27	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.12 Guaranteed Technical Particulars of 11KV Single Phase Lightning Arrester

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
01	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
02	Country of origin		To be mentioned.	
03	Place of manufacture		To be mentioned.	
04	Manufacturer's model No.	-	To be mentioned	
05	Type of the Arrester	-	Metal Oxide (ZnO), Gapless-Outdoor (Single Unit,)	
06	Rated Arrester Voltage	kV	9	
07	Continuous Operating Voltage (COV, Uc)	kV	8- 10 kV	
08	Nominal Discharge Current (8/20micro sec)	KA	5	
09	Type of Lightning Arrester housing	-	Porcelain/polymer (Hydrophobic silicon)	
10	Power Frequency withstand voltage of the Arrester Housing, Dry & Wet	kV rms	≥ 35 kV (Dry) & 30 kV (Wet)	
11	Impulse withstand Voltage of the Arrester Housing.	kV (peak)	≥75 kV (peak)	
12	Lightning Impulse Residual Voltage (8/20 micro-second wave)	kV (peak)	35 kV (peak)	
13	Temporary Over voltage capability**:**			
14	a) 0.1 Second	kV (peak)	To be mentioned	
	b) 1.0 Second	kV (peak)	To be mentioned	
	c) 10 Second	kV (peak)	To be mentioned	

	d) 100 Second	kV (peak)	To be mentioned	
	Leakage Current at rated voltage	mA	< 1 mA	
15	**Total Creepage distance (minimum)**	mm/ kV	25	
16	Overall dimension **:**			
17	a) Height	mm	To be mentioned	
	b) Diameter	mm	To be mentioned	
	Total weight of Arrester	Kg.	To be mentioned	
18	Line discharge class	-	Shall be mentioned	
19	Short Circuit Current Withstand duration	Sec	25kA, 1 sec	
20	Minimum Energy Discharge capability (KJ/KV) at rated voltage	-	Shall be provided	
21	Min. Bending load (kgm)		Shall be provided	
22	Reference Standard	-	IEC 60099-4	
23	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal & Signature
of the Manufacturer

Seal & Signature
of the Bidder

8.13 Guaranteed Technical Particulars of 11kV Gas Insulated Switchgear with Protection and Control Equipment

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, Otherwise bid shall be rejected. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

	DESCRIPTION	UNIT	BPDB REQUIREMENT	BIDDER'S GUARANTEED VALUES
	TRANSFORMER INCOMING SWITCHGEAR UNITS :			
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
2.	Manufacturer country of origin		USA/UK/EU/Japan/ South Korea/Malaysia	
3.	Type/ Model		Shall be mentioned	
4.	Applied Standard		Latest version of IEC 62271 fully complied	
5.	Rated nominal Voltage	kV	11	
6.	Rated maximum Voltage	kV	12	
7.	Rated Frequency	Hz	50	
8.	Rated Current for main bus	A	2500	
9.	Cross section of Bus bar	mm2	2000 mm2 or as per IEC62271	
10.	Material of Bus-Bar		HDHC Copper	
11.	Rated short time current	KA	25	
12.	Short time current rated duration	Sec.	3	
13.	Rated normal current : Incoming feeder from Transformer	A	2500 A	
	a)Pressure relief device is integrated with each gas chamber and pressure relief duct up to		Yes	

	outside the room			
	b)Percentage of Gas leakage per year of each gas filled compartment (same as mentioned in Type Test)		<0.1%	
14	Mimic diagram is depicted in front Of switch gear panel		Yes	
15	ElectricalandMechanicalinterlockbetweenCircuitbreaker,isolatorandearthswitch		Yes	
16	Capacitive Voltage Indicator		Yes	
17.	**Circuit Breaker :**			
	Type		VCB	
	Class of Circuit Breaker (through necessary Type test)		E2M2 or better	
	Insulation media		SF_6	
	Interrupting media		Vacuum	
	Rated Voltage	kV	12	
	Rated Current	A	2500	
	Rated Short Ckt. Breaking Current	KA	25	
	Rated Short Ckt. Making Current	KA	63.5	
	Rated Breaking time	Cycle	≤5	
	Opening time	Sec.	Shall be mentioned	
	Closing time	Cycle	≤5	
	Rated operating Sequence		0-0.3 sec-CO-3 min-CO	
	Nos. of Trip coils	-	2	
	Manufacturer's name and country	-	Shall be mentioned	

	Of origin of Vacuum interrupter (Shall be same as mentioned in Type Test Report)			
	Manufacturer's model no. of vacuum interrupter		Shall be mentioned	
	Guaranteed no. of operation for Vacuum interrupter			
	a) Vacuum interrupter normal condition at rated current switching	nos.	Min 10000	
	b) Vacuum interrupter in short circuit condition i.e. at the short circuit current switching	nos.	≥ 50	
	Control Voltage	V	DC 110	
	AC Voltage for the Universal Motor for spring charge	V	AC 240	
	Power Consumption of Charging motor	W	max 240	
	Power consumption of closing coil	W	Shall be mentioned	
	Power consumption of opening coil	W	Shall be mentioned	
18.	**Three position disconnector Switch** (Motor and manually operated)			
	Type		Shall be mentioned	
	Rated Voltage	KV	12	
	Rated Current	A	2500	
	Rated short time current	KA	25	
	Short time current rated duration	Sec.	3	
	Switch Position		open, close, earth	
	Electrical and Mechanical interlock		As per IEC 62271-200	

19.	**Current Transformer :**			
	Rated Voltage	KV	12	
	Accuracy Class, Metering		0.2 & F.S. < 5	
	Accuracy Class, Protection		5 P20	
	Rated Current ratio:- Transformer Incoming Feeder	A	900-1800/5-5-5A	
	Burden for metering	VA	15 (at max CT ratio)	
	Burden for protection	VA	15 (at max CT ratio)	
	Extended Current Rating for metering	A	120% of rated Current	
	Type	-	Ring Core/Block type with sensor	
	Knee Point Voltage (Minimum) (Supported by Calculation) a) Measuring Core b) Protection Core	 V V	 Shall be mentioned Shall be mentioned	
	CT Burden shall meet the short circuit current(25kA, 3s) (Supported by Calculation)	-	Yes	
19.1	**Voltage Transformer:**			
	Number of Phase		Single Phase	
	Rated primary Voltage	KV	11/√3	
	Rated secondary voltage	V	110/√3	
	Rated Burden	VA	20	
	Accuracy Class (Metering & Protection core)		0.2 & 3P	
	Type		Resin Cast	
	Mounting on incoming panel at bus		Yes	

20	**OVER CURRENT & EARTH FAULT PROTECTION RELAY**			
	Manufacturer's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland /Siemens -Germany/ Schneider-France /UK/Alstom(UK/France)/ NR, China/SEL, USA	
	Manufacture's model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable	
	The relay shall have IEC 61850 communication Protocol.		Yes	
	Directional Feature can be activated/de-activated	Yes/No	Yes	
	Range of current setting : ➢ Phase element ➢ Each fault element	% of CT rating	 Shall be mentioned Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	32	
	No of Binary Output (Minimum)	-	32	
	No of Communication Ports xvii) Electrical xviii) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Directional and Non-Directional O/C, E/F, Over/ Under Voltage, Over and Under Frequency Sync Check and Other Necessary Functions.	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	

	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Drop off to Pick up ratio	%		
	Reset time after removal of fault current			
	a) Phase element (100%)	Sec	Shall be mentioned	
	b) E/F element (40%)	Sec	Shall be mentioned	
20.1	**SEPARATE STANDBY EARTH FAULT PROTECTION**			

20.1	Manufacture's name & country	-	ABB- (Sweden/ Switzerland/ Finland) / Siemens- (Germany)/ Alstom- (France/UK)/ Schneider- (France/UK) / NR, China/SEL USA.	
20.2	Manufacture's model no.	-	To be mentioned	
20.3	Type of relay	-	Numerical programmable with all necessary features	
20.4	Range of current setting : a) Phase element (% of CT rating) b) Earth fault element (% of CT rating)	 % %	 To be mentioned To be mentioned	
20.5	Range of timing settings	Sec	To be mentioned	
20.6	Burden of relay at 20 time CT rating	VA	To be mentioned	
20.7	Percentage of current setting at which relay will reset	%	To be mentioned	
20.8	Reset time after removal of 10 time CT rated current for : a) Phase element (100%) b) E/F element (40%)	 Sec Sec	 To be mentioned To be mentioned	
21	**Trip Relays**			
	Manufacturer's Name and Country		To be mentioned	
	Manufacturer's Model/type No.		To be mentioned	
	Operating Times		<10	
	Self-reset type for O/C, E/F protection		Yes	
22	**Trip Circuit Supervision Relay**			
	Manufacture's name & country of relay		To be mentioned	
	Manufacture's model no.		To be mentioned	
23	**METERING KWh Meter**			

	Manufacture's Name	-	Shall be mentioned	
	Manufacture's Country		European Country/ North American Country/Japan/Australia.	
	Manufacture's Model no.		Shall be mentioned	
	Type of meter		Numerical programmable	
	Class of accuracy		0.2 S	
24	**INDICATION VOLT & AMPERE METERS**			
	Manufacturer's Name and Country			
	Manufacture's Model no.		Shall be mentioned	
	Type of meter		Analogue	
	Class of Accuracy		1.0	
	Separate A-meter for each phase		Yes	
26	**Annunciator**			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Windows	nos.	16	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	
27	**Cable Compartment :**			
	Rated Current	A	2500	
	Cable connection		2x 1C×630mm² / Phase XLPE armoured copper cable plug-socket with all accessories required for termination with proper cable support shall be provided. Sealing/cap for unused cable termination shall	

			also to be provided.	
	Capacitive Voltage Indicator		Shall be incorporated in the front side of the panel	
28	**Insulation level :**			
	AC withstand voltage 1 min. dry	KV	28	
	Impulse Withstand, full wave	KV	75	
29	**Degree of Protection**			
	Enclosure		IP3X	
	HV Compartment		IP65	
	LV Compartment		IP40	
	Cable Compartment		IP40	
30	**Earthing Switch :**			
	Type		Shall be mentioned	
	Short Time Current, 3 secs	KA	Shall be mentioned	
31	**Dimension and Weight**			
	Height	mm	Max. 2200	
	Width	mm	shall be mentioned	
	Depth	mm	shall be mentioned	
	Weight including Circuit Breaker	Kg.	shall be mentioned	
BUS COUPLER (WITH RISER) SWITCHGEAR UNIT :				
32	a) Manufacturer's Name & Address		Shall be mentioned	
	b) Manufacturer country of origin		Shall be mentioned	
33	Type/ Model		Shall be mentioned	
34	Applied Standard		Shall be mentioned	
35	Rated nominal Voltage	kV	11	
36	Rated Maximum Voltage	kV	12	

37	a) Rated Current for main bus	A	2500	
	b) Cross section of Bus bar	mm2	2000 mm2 for 2500A or as per IEC62271	
38.	Material of Bus-Bar		HDHC Copper	
39.	Rated short time current	KA	25	
40.	Short time current rated duration	Sec.	3	
	a)Pressure relief device is integrated with each gas chamber and pressure relief duct up to outside the room		Yes	
	b)Percentage of Gas leakage per year of each gas filled compartment (same as mentioned in Type Test)		<0.1%	
41	Mimic diagram is depicted in front Of switchgear panel		Yes	
42	ElectricalandMechanicalinterlockbetweenCircuitbreaker,isolatorandearthswitch		Yes	
43	**Circuit Breaker :**			
	Type		VCB	
	Insulation media		SF_6	
	Interrupting media		Vacuum	
	Class of Circuit Breaker(through necessary Type test)		E2M2 or better	
	Rated Voltage	KV	12	
	Rated Current	A	2500	
	Rated Short Ckt. Breaking Current	KA	25	

	Rated Short Ckt. making Current	KA	63.5	
	Rated Breaking time	Cycle	≤5	
	Opening time	Sec.	Shall be mentioned	
	Closing time	Sec.	shall be mentioned	
	Control Voltage	V	DC 110	
	AC Voltage for the Universal Motor for spring charge	V	AC 240	
	Nos. Of Trip coils	-	2	
	Manufacturer's name and country Of origin of Vacuum interrupter (Shall be same as mentioned in Type Test Report)	-	Shall be mentioned	
	Manufacturer's model no. of vacuum interrupter		Shall be mentioned	
	Guaranteed no. of operation for Vacuum interrupter:			
	a) Vacuum interrupter normal condition at rated current switching	nos.	Min 10000	
	b) Vacuum interrupter in short circuit condition i.e. at the short circuit current switching	nos.	≥ 50	
44.	**Three position disconnector Switch** (Motor and manually operated)			
	Type		Shall be mentioned	
	Rated Voltage	KV	12	
	Rated Current	A	2500	
	Rated short time current	KA	25	
	Short time current rated duration	Sec.	3	
	Switch Position		close, open, earth	

	Electrical and Mechanical interlock		As per IEC 62271-200	
45.	**Current Transformer :**			
	Rated Voltage	kV	12	
	Accuracy Class, Metering		0.2 & F.S. < 5	
	Accuracy Class, Protection		5P20	
	Rated Current ratio	A	900-1800/5-5	
	Burden	VA	15	
	Rated frequency	Hz	50	
	Type	-	Ring Core/Block type with sensor	
	Knee Point Voltage (Minimum) (Supported by Calculation) c) Measuring Core d) Protection Core	 V V	 Shall be mentioned Shall be mentioned	
	CT Burden shall meet the short circuit current(25kA, 3s) (Supported by Calculation)	-	Yes	
46.	**Insulation level :**			
	AC withstand voltage 1 min. dry	kV	28	
	Impulse Withstand, full wave	kV	75	
47.	**Degree of Protection**			
	Enclosure		IP3X	
	HV Compartment		IP65	
	LV Compartment		IP40	
	Cable Compartment		IP40	
48	**Earthing Switch :**			
	Type		Shall be mentioned	
	Short Time Current, 3 secs	KA	Shall be mentioned	
49	**Dimension and Weight**			

	Height	mm	Max. 2200	
	Width	mm	shall be mentioned	
	Depth	mm	shall be mentioned	
	Weight including Circuit Breaker	Kg.	shall be mentioned	
50	**OVER CURRENT & EARTH FAULT PROTECTION RELAY**			
	Manufacturer's Name Country of Origin	-	ABB- Sweden, Switzerland, Finland /Siemens -Germany/ Schneider-France /UK/Alstom(UK/France)/ NR, China/SEL, USA	
	Manufacture's model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable	
	The relay shall have IEC 61850 communication Protocol.		Yes	
	Directional Feature can be activated/de-activated	Yes/No	Yes	
	Range of current setting : ➢ Phase element ➢ Each fault element	% of CT rating	 Shall be mentioned Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	32	
	No of Binary Output (Minimum)	-	24	
	No of Communication Ports xix) Electrical xx) Optical	-	Shall be mentioned with type.	

	Protection Function	-	Directional and Non-Directional O/C, E/F, Over/ Under Voltage, Over and Under Frequency Sync Check and Other Necessary Functions.	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	
	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Drop off to Pick up ratio	%		
	Reset time after removal of fault current			
	a) Phase element (100%)	Sec	Shall be mentioned	
	b) E/F element (40%)	Sec	Shall be mentioned	

51	**Trip Relay**			
	Manufacturer's Name and Country		To be mentioned	
	Manufacturer's Model/type No.		To be mentioned	
	Operating Times		<10	
	Self-reset type for O/C, E/F protection		Yes	
52	**Trip Circuit Supervision Relay**			
	Manufacture's name & country of relay		To be mentioned	
	Manufacture's model no.		To be mentioned	
53	**INDICATION** **AMPERE METERS**			
	Manufacturer's Name and Country	-	Shall be mentioned	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of meter	-	Analogue	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
54	**INDICATION VOLT METERS**			
	Manufacturer's Name and Country	-		Shall be mentioned
	Manufacture's Model no.	-		Shall be mentioned
	Type of meter	-		Analogue
	Class of Accuracy	-	1.0	
	2 nos. voltmeter with seven (7) position voltage selector switch for observing two (2) bus's bus voltage	-	Yes	
55	**Control Switch**			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model/Type No.		Shall be mentioned	

	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch		Yes	
56	**Annunciator**			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	
11 kV OUTGOING FEEDER SWITCHGEAR UNITS :				
57.	a) Manufacturer's Name & Address		Shall be mentioned	
	b) Manufacturer country of origin		USA/UK/EU/Japan/ South Korea/Malyasia	
58	Type/ Model		Shall be mentioned	
59	Applied Standard		Shall be mentioned	
60	Rated nominal Voltage	kV	11	
61.	Rated maximum Voltage	kV	12	
62.	Material of Bus-Bar		HDHC Copper	
63.	a) Rated Current for main bus	A	2500	
	b) Cross section of Busbar	mm2	2000 mm2 or as per IEC62271	
64	Rated short time current	KA	25	
65	Short time current rated duration	Sec.	3	
66	**Circuit Breaker :**			
	Type		VCB	
	Insulation media		SF_6	

	Interrupting media		Vacuum	
	Rated Voltage	KV	12	
	Rated Current	A	630	
	Rated Short Ckt. Breaking Current	KA	25	
	Rated Short CKt. making Current	KA	63.5	
	Rated Breaking time	Cycle	≤5	
	Opening time	Sec.	To be mentioned	
	Closing time	Sec.	To be mentioned	
	Rated operating Sequence		0-0.3 sec-CO-3 min-CO	
	Control Voltage	V	DC 110	
	AC Voltage for the Universal Motor for spring charge	V	AC 240	
	Nos. Of Trip coils	-	2	
	Manufacturer's name and country Of origin of Vacuum interrupter (Shall be same as mentioned in Type Test Report)	-	Shall be mentioned	
	Manufacturer's model no. of vacuum interrupter		Shall be mentioned	
	Guaranteed no. of operation for Vacuum interrupter:			
	a) Vacuum interrupter normal condition at rated current switching	nos.	Min 10000	
	b) Vacuum interrupter in short circuit condition i.e. at the short circuit current switching	nos.	≥ 50	
67.	**Three position disconnector Switch** (Motor and manually			

	operated)			
	Type		Shall be mentioned	
	Rated Voltage	KV	12	
	Rated Current	A	630	
	Rated short time current	KA	25	
	Short time current rated duration	Sec.	3	
	Switch Position		close, open, earth	
	Electrical and Mechanical interlock		As per IEC 62271-200	
68	**Current Transformer :**			
	Rated Voltage	KV	12	
	Accuracy Class, Metering		0.2 & F.S. < 5	
	Accuracy Class, Protection		5P20 (if burden is 20VA) or 5P30 (if burden is 15VA)	
	Rated Current ratio	A	200-400/5-5A	
	Burden	VA	15 / 20	
	Rated frequency	Hz	50	
	Type	-	Ring Core/Block type with sensor	
	Knee Point Voltage (Minimum) (Supported by Calculation) e) Measuring Core f) Protection Core	 V V	 Shall be mentioned Shall be mentioned	
	CT Burden shall meet the short circuit current(25kA, 3s) (Supported by Calculation)	-	Yes	
69	**OVER CURRENT & EARTH FAULT PROTECTION RELAY**			
	Manufacturer's Name	-	ABB- Sweden, Switzerland, Finland /Siemens -Germany/	

	Country of Origin		Schneider-France /UK/Alstom(UK/France)/ NR, China/SEL, USA	
	Manufacture's model no.	-	Shall be mentioned	
	Type of relay	-	Numerical programmable	
	The relay shall have IEC 61850 communication Protocol.		Yes	
	Directional Feature can be activated/de-activated	Yes/No	Yes	
	Range of current setting : ➢ Phase element ➢ Each fault element	% of CT rating	 Shall be mentioned Shall be mentioned	
	Relay Nominal operating voltage	-	110Vdc	
	Relay CT Current rating	-	5A	
	No of Binary Input (Minimum)	-	24	
	No of Binary Output (Minimum)	-	24	
	No of Communication Ports xxi) Electrical xxii) Optical	-	Shall be mentioned with type.	
	Protection Function	-	Directional and Non-Directional O/C, E/F, Over/ Under Voltage, Over and Under Frequency Sync Check and Other Necessary Functions.	
	Relay Configuration Software (Name, Manufacturer, Version, License Requirement (with name and version))	-	Shall be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Range of timing settings	Sec	Shall be mentioned	

	Burden of relay at 20 time CT rating	VA	Shall be mentioned	
	Drop off to Pick up ratio	%		
	Reset time after removal of fault current			
	a) Phase element (100%)	Sec	Shall be mentioned	
	b) E/F element (40%)	Sec	Shall be mentioned	

70	**Trip relay**			
	Manufacturer's Name and Country		To be mentioned	
	Manufacturer's Model/type No.		To be mentioned	
	Operating Times		<10	
	Self-reset type for O/C, E/F protection		Yes	
71	**Trip Circuit Supervision Relay**			
	Manufacture's name & country of relay		To be mentioned	
	Manufacture's model no.		To be mentioned	
72	**METERING KWh Meter**			
	Manufacture's Name & Country	-	Shall be mentioned	
	Manufacture's Country		European Country/ North American Country/Japan/Australia.	
	Manufacture's Model no.	-	Shall be mentioned	
	Type of meter	-	Numerical programmable	
	Class of accuracy	-	0.2 S	
73	**INDICATION AMPERE METERS** Manufacturer's Name and Country	-		

	Manufacture's Model no. Type of meter	- -	Shall be mentioned Analogue	
	Class of Accuracy	-	1.0	
	Separate A-meter for each phase	-	Yes	
74	**Control Switch**			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model/Type No.		Shall be mentioned	
	Separate TNC/Discrepancy switch and Local Remote (L/R) selector switch		Yes	
75	**Annunciator**			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	
76	**Cable Compartment :**			
	Rated Current	A	Shall be mentioned	
	Cable connection		3C x 185 mm^2 XLPE armoured copper cable with provision for 1 nos./ feeder Panel. Copper cable plug-socket with all accessories required for termination with proper cable support shall be provided. Sealing/cap for unused cable termination shall also to be provided.	

	Capacitive Voltage Indicator		Shall be incorporated in the front side of the panel	
77.	**Insulation level :**			
	AC withstand voltage I min. dry	KV	28	
	Impulse Withstand, full wave	KV	75	
78.	**Degree of Protection and safety indicator**			
	Enclosure		IP3X	
	HV Compartment		IP65	
	LV Compartment		IP40	
	Cable Compartment		IP40	
79.	**Earthing Switch :**			
	Type		Shall be mentioned	
	Short Time Current, 3 sec.	KA	Shall be mentioned	
80.	**Bus bar :**			
	Material		Copper	
	Cross Section	mm^2	2000	
81.	**Dimension and Weight**			
	Height	mm	Max2200	
	Width	mm	Shall be mentioned	
	Depth	mm	Shall be mentioned	
	Weight including Circuit Breaker	Kg.	Shall be mentioned	
82	# The PCM Panel for all feeders shall be complied all the technical specification mentioned in Section-7.	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.14 Guaranteed Technical Particulars of Ni-Cd Battery (110 V DC)

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer 's guaranteed Particulars
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2.	Manufacturer's model no.	-	To be mentioned	
3.	Type	-	Nickel Cadmium Alkaline (enclosed type)	
4.	Operating Voltage	V	110 DC	
5.	Continuous Discharge Current at rate of 10 hour & Final Cell Voltage 1.1 Volt	Amp	10	
6.	Short Time Discharge Current at rate of 2 hour & Final Cell Voltage 1.1 Volt	Amp	50	
7.	Electrolyte type	-	To be mentioned	
8.	Capacity at 5 hour rate	Ah	≥160	
9.	Discharge Voltage	Volt	1.0 to 1.14 V Per Cell	
10.	Charging Voltage (Float)	Volt	1.4 V Per Cell	
11.	Number of cells	Nos.	92 nos. + 5 nos. Spare	
12.	Nominal Voltage per cell	Volt	1.2	
13.	Charging Voltage (Boost)	Volt	1.75 V Per Cell	
14.	Normal float charge rate	A	To be mentioned	
15.	Maximum boost charge rate	A	To be mentioned	
16.	Amp hour efficiency at : a) 10 hour rate b) 1 hour rate	 % %	 To be mentioned To be mentioned	
17.	Size of cell	mm	To be mentioned	
18.	Weight of cell and electrolyte	kg	To be mentioned	
19.	Standard	-	As per Latest Edition of applicable IEC-60623	
20.	Specific gravity of electrolyte	-	To be mentioned	
21.	Release pressure for valve regulated type	kg/m^2	To be mentioned	
22.	Volume of electrolyte per cell	ml	To be mentioned	
23.	Volume of reserve electrolyte per cell	ml	To be mentioned	
24.	No of electrode plates per cell	Nos.	To be mentioned	

25.	Type of racks & Dimension (a)Height (b)Width (c)Depth	-	To be mentioned	
26.	Cell dimension: (a) Height (b) Width (c) Depth	 mm mm mm	To be mentioned	
27.	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.15 Guaranteed Technical Particulars of Battery Charger

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's guaranteed Particulars
1.	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
2.	Year of Manufacturing	Yr.	Not before 2022	
3.	Country of Origin		To be mentioned	
4.	Manufacturer's model no.	-	To be mentioned	
5.	Rated Input voltage range	V AC	415 V ± 10%	
6.	Rated Frequency	Hz	50 Hz (± 3%),	
7.	No of Phase	-	03	
8.	Control	-	Shall be mentioned	
9.	Communication module for station automation	-	Shall be provided	
10.	Rectifier type	-	Silicon	
11.	Nominal output voltage	V DC	110	
12.	Chargingoperating control	-	Boost and floating charge, automatic with manual operation	
13.	Output current	A DC	≥ 100	
14.	Continuous current rating	-	110 % of rated current	
15.	Efficiency	-	≥ 85% at full load @ Nominal AC Input	
16.	Voltage regulation	-	≤ ±1 %	
17.	Ripple voltage	-	≤ 2 % rms	
18.	Float charging voltage	V/Cell	1.35 to 1.45 (programmable)	
19.	Boost charging voltage	V/Cell	1.6 to 1.75 (programmable)	
20.	Boost charging time	hour	programmable	
21.	Operating temperature	°C	0 to 50	
22.	Humidity	%	95	
23.	Audible noise	dB	≤ 65	

24.	Facilities for paralleling with another charger	-	Shall be provided	
25.	Protection against surge voltage	-	Shall be provided	
26.	Protection against reverse polarity	-	Shall be provided	
27.	Provision for current limiting	-	Shall be provided	
28.	Dropping Diodes unit at in the output circuit during Boost Mode	-	Yes	
29.	Provision of constant voltage charge 90V -130V	-	Shall be provided	
30.	Provision of showing earth leakage current by analog meter	-	Shall be provided	
31.	Battery Temperature compensation	-	Shall be incorporated.	
32.	Alarm annunciator independent ofthe microprocessor	-	Shall be provided	
33.	Analog/Digital meters for voltage and current measurement of input,output and battery power	-	Shall be provided	
34.	Dimension	-	Shall be mentioned	
35.	Output voltage range a) normal charge b) Float charge c) boost charge	 V DC V DC V DC	 110 V ± 1% 128 V ± 1% 156 V ± 1%	
36.	Normal/ boost charge independent units?	Yes/ No	To be mentioned	
37.	Rated Battery Ah @ C_5 rate	Ah	≥160	
38.	Type of AVR	-	Static	
39.	Installation Break Down Voltage	KV	2kV for 1 Minute	
40.	Type of rectifier	Thyristor	To be mentioned	
41.	MCCB Rating			
	For AC input	A	25(Min.)	
	For DC main Output	A	125 (Min.)	
	For DC Battery Output	A	63 (Min.)	
42.	Standard	-	As per Latest Edition of applicable IEC-60146	
43.	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

44.	Charger controller shall have IEC61850 communication protocol for SAS implementation. All the measurement data, controlling & operation facility of the charger shall be available at SAS.	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.16 GUARANTEED TECHNICAL DATA SCHEDULE FOR 33/11KV, 20/26MVA POWER TRANSFORMER

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1.	**RATING AND PERFORMANCE**			
1.1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Manufacturer's country of Origin		To be mentioned	
	c) Year of Manufacturing	Yr.	Not before 2022	
1.2	Manufacturer's Model no.	-	To be mentioned	
1.3	Continuous maximum rating (ONAN / ONAF)	MVA	20/26	
1.4	No. of phases	Nos.	3	
1.5	Rated frequency	Hz	50	
1.6	Normal transformation ratio at No-load and Principal Tap	kV	33/11.55	
1.7	Rated HT voltage (phase to phase)	kV	33	
1.8	Maximum HT voltage (phase to phase)	kV	36	
1.9	Rated LT voltage (phase to phase)	kV	11	
1.10	Maximum LT voltage (phase to phase)	kV	12	
1.11	Installation	-	Outdoor	
1.12	Type of Transformer	-	Core, Conservator, Oil immersed	
1.13	Direction of normal power flow	-	HT-LT	
1.14	No of windings	Nos.	2	
1.15	Bushing materials	-	Porcelain	

1.16	Type of cooling	-	ONAN/ONAF	
1.17	Coolant	-	Type- A, Unused insulating mineral oil, free from PCB (polychlorinated biphenyl)	
1.18	Type of earthing	-	Effectively earth	
1.19	Type of base	-	On wheels with adequate size and length of rails and fixing arrangement	
1.20	**Phase connection:** a) 33 KV winding with bushing CT b) 11KV winding with bushing CT	 - -	 Delta Star	
1.21	Vector group	-	Dyn11	
1.22	Neutral to be brought out : a) HT b) LT	 - -	 Nil Yes	
1.23	Basic Insulation Level (BIL) : a) High voltage winding b) Low voltage winding	 KV KV	 170 75	
1.24	Max. Temp. Rise over 40^0C of ambient (at CMR & normal tap change position) supported by Design Calculation sheet (to be enclosed) on the basis of Design Data:-			
	a) Winding Temp. Rise b) Top Oil Temp. Rise	^{0}C ^{0}C	65 55	
	TEST VOLTAGE :			

1.25	Impulse front wave test voltage (1.2/50 micro sec. wave shape) : a) High voltage side b) low voltage side	 kV kV	 170 75	
1.26	Power Frequency withstand test voltage for 1 (one) minute : a) High voltage side b) Low voltage side	 kV kV	 70 28	
1.27	Short circuit MVA available : a) at 33 KV b) at 11KV	 MVA MVA	 1800 500	
1.28	Impedance voltage at 75 ^{0}C and at normal ratio and rated frequency and at ONAN condition (supported by type test report).	%	8.5%	
1.29	All windings shall have uniform insulations	-	Yes	
2.	**VOLTAGE CONTROL (OLTC)**			
2.1	Type of Tap Changer control	-	On load auto regulation and remote & manual control	
2.2	OLTC, MDU & AVR Manufacturer's name & country	-	MR Germany/ABB, Sweden/HM, China	
	c) Year of Manufacturing	Yr.	Not before 2022	
2.3	Model Number		Shall be mentioned	
2.4	Nos. of tapping	-	17	
2.5	Tapping steps	-	±10% in steps of	

			1.25% 17 tapping (i.e. 33±8x1.25%)	
2.6	HV or LV winding	-	HV winding	
2.7	Power Frequency withstand test voltage between first and last contracts of the selector switch between diverter and switch contract.	kV	75	
2.8	Rated Voltage for control circuit		Shall be mentioned	
2.9	Power Supply for control motor		Shall be mentioned	
3.	**GENERAL**			
3.1	Manufacturer's Name & Address		To be mentioned	
3.2	Material of core & grading		To be mentioned	
3.3	Core Loss/ Kg, supported by Characteristic Curve (to be submitted)		To be mentioned	
3.4	Thickness of core, mm		To be mentioned	
3.5	Core Dia, mm		To be mentioned	
3.6	Total weight of core, Kg		To be mentioned	
3.7	Maximum flux density in iron at normal voltage and frequency and at normal ratio (ONAF condition) a) Cores b) Yokes	 Tesla Tesla	 < 1.7 To be mentioned	
3.8	Magnetizing current (approx.)	%	To be mentioned	
3.9	a) No load losses at rated voltage, ratio and frequency (supported by type test report).	KW	**12 – 20**	

	b) Full Load losses at rated voltage, normal ratio & frequency in ONAN condition at 75^0C. c) Full Load losses at rated voltage, normal ratio & frequency in ONAF condition at 75^0C (supported by type test report). d) Auxiliary Losses e) Total Loss (a+c+d)	KW KW KW KW	To be mentioned **90 – 120** To be mentioned To be mentioned	
3.10	Maximum current density in core at CMR	A/mm^2	To be mentioned	
3.11	Simultaneous operating conditions under which maximum flux density is attained: a) Frequency b) Voltage- HV LV c) Tap d) Load	 Hz KV KV - MVA and P.F.	 To be mentioned To be mentioned To be mentioned To be mentioned	
3.12	Maximum flux density in iron under conditions entered on line 3.7	Tesla	To be mentioned	
3.13	(a) Maximum current density in HV winding at Continuous Maximum Running (CMR) (b) Cross section of HV winding	A/mm 2 mm2	< 2.5	
3.14	(a) Maximum current density in LV winding at Continuous Maximum Running (CMR)	A/mm 2	< 2.5	

	(b) Cross section of LV winding	mm2		
4.	**DETAILS OF CONSTRUCTION**			
4.1	Types of winding: a) HV b) LV	-	To be mentioned	
4.2	Copper Conductor's Manufacturer Name & Address		To be mentioned	
4.3	Material of windings	-	copper	
4.4	Winding resistance of : a) H.T. winding, b) L.T. winding,	 Ohm. Ohm.	 To be mentioned To be mentioned	
4.5	Current density of : a) H.T. winding, Amps/sq. mm b) L.T. winding, Amps/sq. mm	 A/mm^2 A/mm^2	 < 2.5 < 2.5	
4.6	Outer, Inner & Mean dia of copper winding: a) H.T. winding, b) L.T. winding,	 mm mm	 To be mentioned To be mentioned	
4.7	Size of Copper conductor/bar : a) H.T. winding SWG, dia. in mm / area in mm^2 b) L.T. winding SWG, area in mm^2		 To be mentioned To be mentioned	
4.8	Number of Turns : a) HT winding. b) LT winding	 nos. nos.	 To be mentioned To be mentioned	

4.9	Copper weight of windings : a) HT winding b) LT winding	 Kg Kg	 To be mentioned To be mentioned	
4.10	Total weight of copper windings	Kg	To be mentioned	
4.11	Insulation Class Insulation Material Insulation Weight Type of insulation of : a) Tapping b) Tapping connections c) Core bolts d) Core bolt washers e) Side plates f) Core laminations	-	To be mentioned To be mentioned To be mentioned	
4.12	Type of winding connections (crimped or brazed)	-	To be mentioned	
4.13	Thickness of transformer tank: b) Top c) Sides d) Bottom	 mm mm mm	 To be mentioned To be mentioned To be mentioned	
4.14	Vacuum withstand capability of the tank			
	Main tank	Kpa		
	Conservator	Kpa		
	Radiators	Kpa		
4.15	Provision of tank earthing and Core earthing	-	Yes	

4.16	Bladder / Air bag in Conservator	-	Yes	
4.17	Material used for gaskets for oil tight joints	mm	To be mentioned	
5.	**RADIATORS**			
5.1	Thickness of radiator plates/ cooling tubes	mm	To be mentioned	
5.2	Equipment for ON cooling state a) radiators on main tank	- -	 To be mentioned	
5.3	Number of radiators per transformer	Nos.	To be mentioned	
5.4	Rating of each radiator bank	KW	To be mentioned	
5.5	Power of each fan	KW	To be mentioned	
5.6	Nos. of fans	Nos.	To be mentioned	
6.	**Oil Volume and Weight**			
6.1	Type of oil		Type- A, Unused insulating mineral oil, free from PCB (polychlorinated biphenyl)	
6.2	Manufacturer Name of oil		Shall be mentioned	
6.3	Breakdown Voltage at 2.5mm gap between electrodes		>50 kV	
6.4	Appearance		Liquid and free from suspended matter or sediment	
6.5	Density at 20^0 C		0.895 g/cm^3 (maximum)g/cm^3(maximum)	
6.6	Flash point (Closed cup)		140^0 C (minimum)	
6.7	Kinematics Viscosity at -15^0 C		800 cSt. (Maximum)	

6.8	Kinematics Viscosity at 20^0 C		40 cSt. (Maximum)	
6.9	Pour point		-30^0 C (maximum)	
6.10	Neutralization value		0.3 mg KOH/g (maximum)	
6.11	Neutralization value after oxidation		0.40 mg KOH/g (maximum)	
6.12	Total sludge after oxidation		0.05% weight (maximum)	
6.13	PCB Content		Free from PCB	
6.14	Water content		25ppm (maximum)	
6.15	Total oil required including cooler system	Litres	To be mentioned	
6.16	Volume of oil above of the top yoke	Litres	To be mentioned	
6.17	Total volume of conservator	Litres	To be mentioned	
6.18	Weight of core and winding assembly	Tones	To be mentioned	
6.19	Weight of each oil cooler bank complete with oil if mounted separately from transformer	Tones	To be mentioned	
6.20	Total weights of complete transformer, including attached radiators, voltage regulating equipment ,all fittings and oil	Tones	To be mentioned	
6.21	Weight of transformer arranged for transport	Tones	To be mentioned	
6.22	Brief description of transformer or parts thereof subjected to short-circuit test or for which short-circuit calculations are available	-	To be mentioned	
7.	**TRANSFORMER BUSHING INSULATORS**			
7.1	Manufacture's name & country	-	To be mentioned	
7.2	Insulator material	-	Porcelain	
7.3	Bushing housing		Porcelain	

7.4	Bushing Current Rating at 75˚C	A	To be mentioned	
7.5	Insulator type and rated voltage	-	To be mentioned	
7.6	Pitch circle diameter and drilling of flange	mm approx.	To be mentioned	
7.7	Length of Insulator (overall)	mm	To be mentioned	
7.8	Weight of Insulator	kg	To be mentioned	
7.9	One minute 50 Hz dry withstand routine test voltage	KV	To be mentioned	
7.10	Lightning Impulse flashover voltage (1.2/50 wave)	KV	To be mentioned	
7.11	Full wave Lightning Impulse Voltage withstand	KV	To be mentioned	
7.12	50 Hz wet withstand voltage across arcing horns	KV	To be mentioned	
7.13	Under oil flashover voltage type test	KV	To be mentioned	
7.14	Total creepage distance of shedding	mm	Min. 25mm per KV	
7.15	Protected creepage distance of shedding	mm	To be mentioned	
7.16	Rated Short circuit Current withstand capability		31.5kA, 3 sec.	
8.	**BUSHING CTS 33 KV FOR DIFFERENTIAL PROTECTION**			
8.1	Manufacturer's name & country	-	To be mentioned	
8.2	Rated Voltage		33KV	
8.3	Rated maximum Voltage		36KV	
8.4	Ratio	A	600/5	
8.5	Rated output	VA	30 VA	

8.6	Accuracy class	-	5P20	
8.7	Electrical Clearance from phase to phase	mm	To be mentioned	
8.8	Electrical Clearance phase to earth	mm	To be mentioned	
9.	**BUSHING CTS 11 KV FOR DIFFERENTIAL PROTECTION**			
9.1	Manufacturer's name & country	-	To be mentioned	
9.2	Rated voltage	KV	11	
9.3	Rated maximum voltage	KV	12	
9.4	Ratio	A	1800/5	
9.5	Rated output	VA	30 VA	
9.6	Accuracy class	-	5P20	
10.	**NEUTRAL BUSHING CTS 11 KV FOR SEF & REF PROTECTION**			
10.1	Manufacturer's name & country	-	To be mentioned	
10.2	Rated voltage	KV	11	
10.3	Rated maximum voltage	KV	12	
10.4	Ratio	A	1800/5/5	
10.5	Rated output	VA	30 VA	
10.6	Accuracy class	-	5P20	
11.0	**Oil Temperature Indicator**			
	Manufacturer Name		To be mentioned	
	Alarm contact		01No	
	Trip Contact		01No	
	Alarm & Trip Range			
12.0	**Winding Temperature Indicator**			

	Manufacturer Name		To be mentioned	
	Alarm contact		01No	
	Trip Contact		01No	
	Alarm & Trip Range			
13.0	**Dial Thermometer**			
	Alarm Contact		01No	
	Trip Contact		01No	
14.0	Buchholz relay (Both for main tank & OLTC)		Yes/No	
	Manufacturer Name		To be mentioned	
	Make/Model Number		To be mentioned	
	Alarm contact		01No	
	Trip Contact		01No	
15.0	PRD (Both for main tank & OLTC)		Yes/No	
	Manufacturer Name		To be mentioned	
	Make/Model Number		To be mentioned	
	Alarm contact		01No	
	Trip Contact		01No	
16.0	Is terminal permanent terminal marking provided?		Yes/No	
17.0	Parallel operation of identical transformer		Required	
18.0	Marshalling Box		Shall be provided	
19.0	Silica Gel Breather		Shall be provided	
20.0	Guaranteed Noise level as per IEC 551	db		
21.0	Harmonics			

	R.M.S. value of the fundamental current	Amp.	To be mentioned	
	R.M.S. value of 3rd harmonics current	Amp	To be mentioned	
	R.M.S. value of 5th harmonics current	Amp	To be mentioned	
22.0	Type of paint applied internally		To be mentioned	
23.0	Type of paint applied externally		To be mentioned	
24.0	Type of weatherproof anti rust material primer		To be mentioned	
25.0	Dimension of the transformer			
	Length	mm	To be mentioned	
	Width	mm	To be mentioned	
	Height	mm	To be mentioned	
26.0	Standard		Design, Manufacture , Testing, Installation and performance shall be in accordance to the latest edition of the IEC 60076	
28.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	
29.	Oil level indicator device for the transformer main tank.		Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.17 Guaranteed Technical Particulars of 33/11kV, 16/20 MVA Power Transformer

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's Guaranteed Particulars
1.	**RATING AND PERFORMANCE**			
1.1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Manufacturer's country of Origin	-	To be mentioned	
	c) Year of Manufacturing	Yr.	Not before 2022	
1.2	Manufacturer's Model no.	-	To be mentioned	
1.3	Continuous maximum rating (ONAN/ONAF)	MVA	16/20	
	Rated Primary Current (ONAN/ONAF)	A	279.92/349.91	
	Rated Secondary Current (ONAN/ONAF)	A	839.78/1049.72	
1.4	No. of phases	Nos.	3	
1.5	Rated frequency	Hz	50	
1.6	Normal transformation ratio at No-load	kV	33/11.55	
1.7	Rated HT voltage (phase to phase)	kV	33	
1.8	Maximum HT voltage (phase to phase)	kV	36	
1.9	Rated LT voltage (phase to phase)	kV	11	
1.10	Maximum LT voltage (phase to phase)	kV	12	
1.11	Installation	-	Outdoor	
1.12	Type of Transformer	-	Core, Conservator, Oil immersed	
1.13	Direction of normal power flow	-	HT-LT	
1.14	No of windings	Nos.	2	
1.15	Bushing materials	-	Porcelain	
1.16	Type of cooling	-	ONAN/ONAF	
1.17	Coolant	-	Type- A, Unused insulating mineral oil, free from PCB (polychlorinated biphenyl)	
1.18	Type of earthing	-	Effectively earth	

1.19	Type of base	-	On wheels with adequate size and length of rails and fixing arrangement	
1.20	**Phase connection:** a) 33 KV winding with bushing CT b) 11KV winding with bushing CT	 - -	 Delta Star	
1.21	Vector group	-	Dyn11	
1.22	Neutral to be brought out : a) HT b) LT	 - -	 Nil Yes	
1.23	Basic Insulation Level (BIL) : a) High voltage winding b) Low voltage winding	 kVp kVp	 170 75	
1.24	Max. Temp. Rise over 40^0C of ambient (at CMR & normal tap change position) supported by Design Calculation sheet (to be enclosed) on the basis of Design Data:-			
	a) Winding Temp. Rise b) Top Oil Temp. Rise	^{0}C ^{0}C	65 55	
	TEST VOLTAGE :			
1.25	Impulse front wave test voltage (1.2/50 micro sec. wave shape) : a) High voltage side b) low voltage side	 kVp kVp	 170 75	
1.26	Power Frequency withstand test voltage for 1 (one) minute : a) High voltage side b) Low voltage side	 kV kV	 70 28	
1.27	Short circuit MVA available : a) at 33 KV b) at 11KV	 MVA MVA	 1800 500	
	Impedance voltage at 75 ^{0}C and at normal ratio and rated frequency and at ONAN condition	%	8.5%	
1.28	Impedance voltage at 75 ^{0}C and at normal ratio and rated frequency and at ONAF condition	%	Shall be mentioned	
1.29	All windings shall have uniform insulations	-	Yes	
2.	**VOLTAGE CONTROL (OLTC)**			
2.1	Type of Tap Changer control	-	On load auto regulation and remote & manual control	

2.2	OLTC, MDU & AVR Manufacturer's name & country	-	MR Germany/ ABB, Sweden/ HM, China	
	Year of Manufacturing	Yr.	Not before 2022	
2.3	Model Number		Shall be mentioned	
2.4	Nos. of tapping	-	17	
2.5	Tapping steps	-	±10% in steps of 1.25% 17 tapping (i.e. 33±8x1.25%)	
2.6	HV or LV winding	-	HV winding	
2.7	Power Frequency withstand test voltage between first and last contracts of the selector switch between diverter and switch contract.	kV	75	
2.8	Rated Voltage for control circuit	-	Shall be mentioned	
2.9	Power Supply for control motor	-	Shall be mentioned	
3.	**GENERAL**			
3.1	Manufacturer's Name & Address	-	To be mentioned	
3.2	Material of core & grading	-	To be mentioned	
3.3	Core Loss/ Kg, supported by Characteristic Curve & Core Manufacture's Brochure (to be submitted)	-	To be mentioned	
3.4	Thickness of core, mm	-	To be mentioned	
3.5	Core Dia, mm	-	To be mentioned	
3.6	Total weight of core, Kg (Supported by Calculation)	-	To be mentioned	
3.7	Maximum flux density in iron at normal voltage and frequency and at normal ratio (ONAF condition) a) Cores b) Yokes	 Tesla Tesla	 < 1.7 To be mentioned	
3.8	No-load Current	%	To be mentioned	
3.9	a) No load losses at rated voltage, ratio and frequency (supported by type test report). b) Full Load losses at rated voltage, normal ratio & frequency in ONAN condition at 75^0C. c) Full Load losses at rated voltage, normal ratio & frequency in ONAF condition at 75^0C (supported by type test report). d) Auxiliary Losses e) Total Loss (a+c+d)	kW kW kW kW kW	**10 – 17** To be mentioned **80 – 100** To be mentioned To be mentioned	

3.10	Simultaneous operating conditions under which maximum flux density is attained: a) Frequency b) Voltage- HV LV c) Tap d) Load	 Hz kV kV - MVA and P.F.	 To be mentioned To be mentioned To be mentioned To be mentioned	
3.11	Maximum flux density in iron under conditions entered on line 3.6	Tesla	To be mentioned	
3.12	(a) Maximum current density in HV winding at CMR	A/mm^2	2.5	
	(b) Cross section of HV winding	mm^2	To be mentioned	
3.13	(a) Maximum current density in LV winding at CMR	A/mm^2	2.5	
	(b) Cross section of LV winding	mm^2	To be mentioned	
3.14	(a) Maximum current density in Tap winding at CMR	A/mm^2	2.5	
	(b) Cross section of Tap winding	mm^2	To be mentioned	
4.	**DETAILS OF CONSTRUCTION**			
4.1	Voltage per Turn	V/T	50-65	
4.2	Types of winding: a) HV b) LV c) Tap	-	To be mentioned	
4.3	Copper Conductor's Manufacturer Name & Address		To be mentioned	
4.4	Material of windings	-	copper	
4.5	Winding resistance of : a) H.T. winding (per phase at 75 deg C) b) L.T. winding (per phase at 75 deg C) c) Tap Winding (per phase at 75 deg C)	 Ohm. Ohm. Ohm.	 To be mentioned To be mentioned To be mentioned	
4.6	Current density of : (as per design calculation) a) H.T. winding, Amps/sq. mm b) L.T. winding, Amps/sq. mm	 A/mm^2 A/mm^2	 To be mentioned To be mentioned	
4.7	Outer, Inner & Mean dia of copper winding: a) H.T. winding, b) L.T. winding, c) Tap winding	 mm mm mm	 To be mentioned To be mentioned To be mentioned	
	Size of Copper conductor/bar :			

4.8	a) H.T. winding b) L.T. winding c) Tap Winding	-	To be mentioned To be mentioned To be mentioned	
4.9	Number of Turns : a) HT winding. b) LT winding c) Tap Winding	 Nos. nos. nos.	 To be mentioned To be mentioned To be mentioned	
4.10	Copper weight of windings: a) HT winding b) LT winding c) Tap Winding	 Kg Kg Kg	 To be mentioned To be mentioned To be mentioned	
4.11	Total weight of copper windings	Kg	To be mentioned	
4.12	Type of insulation of : a) Tapping b) Tapping connections c) Core bolts d) Core bolt washers e) Side plates f) Core laminations	-	 To be mentioned	
4.13	Type of winding connections (crimped or brazed)	-	To be mentioned	
4.14	Dimension of Transformer Tank: a) Length b) Width c) Height	 mm mm mm	 To be mentioned To be mentioned To be mentioned	
	Thickness of transformer Tank: a) Top b) Sides c) Bottom	 mm mm mm	 To be mentioned To be mentioned To be mentioned	
4.15	Vacuum withstand capability of the tank			
	Main tank	kpa	To be mentioned	
	Conservator	kpa	To be mentioned	
	Radiators	kpa	To be mentioned	
4.16	Provision of tank earthing and Core earthing	-	Yes	
4.17	Bladder / Air bag in Conservator	-	Yes	
4.18	Material used for gaskets for oil tight joints	mm	To be mentioned	
5.	**RADIATORS**			
5.1	Thickness of radiator plates/ cooling tubes	mm	To be mentioned	
5.2	Equipment for ON cooling state			

	a) radiators on main tank	-	To be mentioned	
5.3	Number of radiators per transformer	Nos.	To be mentioned	
5.4	Dimension of each Radiator	-	To be mentioned	
5.5	No. of Fins in each radiator	Nos.	To be mentioned	
5.6	Rating of each radiator bank	kW	To be mentioned	
5.7	Power rating of each Fan	kW	To be mentioned	
5.8	Air flow rate of Fan	m^3/hr	To be mentioned	
5.9	Nos. of fans running at ONAF	Nos.	To be mentioned	
5.10	Nos. of Standby fans (Same Capacity & Model no. as mentioned in 5.9)	Nos.	2	
6.	**OIL VOLUME AND WEIGHT**			
6.1	Type of oil	-	Type- A, Unused insulating mineral oil, free from PCB (polychlorinated biphenyl)	
6.2	Manufacturer Name of oil	-	Shall be mentioned	
6.3	Breakdown Voltage at 2.5mm gap between electrodes	-	>50 kV	
6.4	Appearance	-	Liquid and free from suspended matter or sediment	
6.5	Density at 20^0 C	-	0.895 g/cm^3 (maximum)	
6.6	Flash point (Closed cup)	-	140^0 C (minimum)	
6.7	Kinematics Viscosity at -15^0 C	-	800 cSt. (Maximum)	
6.8	Kinematics Viscosity at 20^0 C	-	40 cSt. (Maximum)	
6.9	Pour point	-	-30^0 C (maximum)	
6.10	Neutralization value	-	0.3 mg KOH/g (maximum)	
6.11	Neutralization value after oxidation	-	0.40 mg KOH/g (maximum)	
6.12	Total sludge after oxidation	-	0.05% weight (maximum)	
6.13	PCB Content	-	Free from PCB	
6.14	Water content	-	25ppm (maximum)	
6.15	Total oil required including cooler system	Litres	To be mentioned	
6.16	Volume of oil above of the top yoke	Litres	To be mentioned	
6.17	Total volume of conservator	Litres	To be mentioned	
6.18	Weight of core and winding assembly	Tones	To be mentioned	
6.19	Weight of each oil cooler bank complete with	Tones	To be mentioned	

	oil if mounted separately from transformer				
6.20	Total weights of complete transformer, including attached radiators, voltage regulating equipment, all fittings and oil	Tones	To be mentioned		
6.21	Weight of transformer arranged for transport	Tones	To be mentioned		
6.22	Brief description of transformer or parts thereof subjected to short-circuit test or for which short-circuit calculations are available	-	To be mentioned		
7.	**TRANSFORMER BUSHING INSULATORS**			LV	HV
7.1	Manufacture's name & country	-	To be mentioned		
7.2	Insulator material	-	Porcelain		
7.3	Bushing housing		Porcelain		
7.4	Bushing Current Rating at 75˚C	A	To be mentioned		
7.5	Insulator type and rated voltage	-	To be mentioned		
7.6	Pitch circle diameter and drilling of flange	mm approx.	To be mentioned		
7.7	Length of Insulator (overall)	mm	To be mentioned		
7.8	Weight of Insulator	kg	To be mentioned		
7.9	One minute 50 Hz dry withstand routine test voltage	kV	To be mentioned		
7.10	Lightning Impulse flashover voltage (1.2/50 wave)	kV	To be mentioned		
7.11	Full wave Lightning Impulse Voltage withstand	kV	To be mentioned		
7.12	50 Hz wet withstand voltage across arcing horns	kV	To be mentioned		
7.13	Under oil flashover voltage type test	kV	To be mentioned		
7.14	Total creepage distance of shedding	mm	Min. 25mm per kV		
7.15	Protected creepage distance of shedding	mm	To be mentioned		
7.16	Rated Short circuit Current withstand capability		31.5KA, 3sec		
8.	**BUSHING CTS 33 KV FOR DIFFERENTIAL PROTECTION**				
8.1	Manufacturer's name & country	-	To be mentioned		
8.2	Rated Voltage	-	33kV		
8.3	Rated maximum Voltage	-	36kV		
8.4	Ratio	A	400/5		
8.5	Rated output	VA	30 VA		
8.6	Accuracy class	-	5P20		

8.7	Knee Point Voltage (Supported by Calculation)	V	To be mentioned	
8.8	Electrical Clearance from phase to phase	mm	To be mentioned	
8.9	Electrical Clearance phase to earth	mm	To be mentioned	
9.	**BUSHING CTS 11 KV FOR DIFFERENTIAL PROTECTION**			
9.1	Manufacturer's name & country	-	To be mentioned	
9.2	Rated voltage	kV	11	
9.3	Rated maximum voltage	kV	12	
9.4	Ratio	A	1200/5	
9.5	Rated output	VA	30 VA	
9.6	Accuracy class	-	5P20	
9.7	Knee Point Voltage (Supported by Calculation)	V	To be mentioned	
10.	**NEUTRAL BUSHING CTS 11 KV FOR SEF & REF PROTECTION**			
10.1	Manufacturer's name & country	-	To be mentioned	
10.2	Rated voltage	kV	11	
10.3	Rated maximum voltage	kV	12	
10.4	Ratio	A	1200/5-5A	
10.5	Rated output	VA	30 VA	
10.6	Accuracy class	-	5P20	
10.7	Knee Point Voltage (Supported by Calculation)	V	To be mentioned	
11.0	**Oil Temperature Indicator**			
	Manufacturer's name & country	-	To be mentioned	
	Model Number	-	To be mentioned	
	Alarm contact	-	02 NO	
	Trip Contact	-	02 NO	
	Cooling Fan Start & Stop Contact		To be provided	
	Alarm & Trip Range	-	To be mentioned	
12.0	**Oil Level Indicator**			
	Manufacturer's name & country	-	To be mentioned	
	Model Number	-	To be mentioned	
	Alarm contact	-	02 NO	
13.0	**Winding Temperature Indicator**		To be mentioned	
	Manufacturer's name & country	-	To be mentioned	
	Model Number	-	To be mentioned	
	Alarm contact	-	02 NO	
	Trip Contact	-	02 NO	
	Cooling Fan Start & Stop Contact		To be provided	
	Alarm & Trip Range	-	To be mentioned	

14.0	**Dial Thermometer**			
	Manufacturer's name & country	-	To be mentioned	
	Model Number	-	To be mentioned	
	Alarm Contact	-	02 NO	
	Trip Contact	-	02 NO	
15.0	**Buchholz relay (Both for main tank & OLTC)**		Yes/No	
	Manufacturer's name & country	-	To be mentioned	
	Model Number	-	To be mentioned	
	Alarm contact	-	02 NO	
	Trip Contact	-	02 NO	
16.0	**PRD (Both for main tank & OLTC)**	-	Yes/No	
	Manufacturer's name & country	-	To be mentioned	
	Model Number	-	To be mentioned	
	Alarm contact	-	02 NO	
	Trip Contact	-	02 NO	
17.0	Is terminal permanent terminal marking provided?	-	Yes/No	
18.0	Parallel operation of identical transformer	-	Required	
19.0	Marshalling Box	-	Shall be provided	
20.0	Silica Gel Breather	-	Shall be provided	
21.0	Guaranteed Noise level as per IEC 551	db	To be mentioned	
22.0	Harmonics			
	R.M.S. value of the fundamental current	Amp.	To be mentioned	
	R.M.S. value of 3rd harmonics current	Amp	To be mentioned	
	R.M.S. value of 5th harmonics current	Amp	To be mentioned	
23.0	Type of paint applied internally	-	To be mentioned	
24.0	Type of paint applied externally	-	To be mentioned	
25.0	Type of weatherproof anti rust material primer	-	To be mentioned	
26.0	Dimension of the transformer	-		
	Length	mm	To be mentioned	
	Width	mm	To be mentioned	
	Height	mm	To be mentioned	
27.0	Standard	-	Design, Manufacture , Testing, Installation and performance shall be in accordance to the latest edition of the IEC 60076	
28.	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature
of the Manufacturer

Seal & Signature
of the Bidder

8. 18 Guaranteed Technical Particularsfor 33/ 0.415 KV, 3-Phase, 250kVA Station Auxiliary Transformer

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, Otherwise bid shall be rejected. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	BPDB'S Requirement	Manufacturer's Guaranteed Data
1	a) Manufacturer's name & address With website, official domain email.	To be mentioned	
	b) Year of Manufacturing	Not before 2022	
	a) Manufacturer's name & address With website, official domain email.	To be mentioned	
2	Manufacturer's Type & Model No.	To be mentioned	
3	KVA Rating	250	
4	Number of Phases	3	
5	Rated frequency, Hz	50	
6	Rated primary voltage, KV	33	
7	Rated no load sec. voltage, V	415	
8	Vector group	Dyn11	
9	Highest system voltage of :		
	a) Primary winding, KV	36	
	b) Secondary winding, V	457	
10	Basic insulation level, KVp	170	
11	Power frequency withstand voltage, KV		
	a) HT Side	70	
	b) LT Side	2.5	
12	Type of cooling	ONAN	
13	Max. Temp. Rise over 40^0C of ambient supported by Calculation (to be submitted) of Load Loss, Temperature Rise and Heat Dissipation by Radiator on the basis of Design Data:		
	a) Windings deg. C	65	
	b) Top oil deg. C	55	
14	Type of primary tapping off load, %	+3x2.5%, 0,	

Sl. No.	Description	BPDB'S Requirement	Manufacturer's Guaranteed Data
		-3x 2.5%	
15	Percentage Impedance at 75° C, %(supported by type test report)	5%	
16	No-load loss, Watts(supported by type test report)	812	
17	Load losses at rated full load at 75°C, Watts(supported by type test report)	3637	
18	Magnetising current at normal voltage, Amps	To be mentioned	
19	Efficiency at 75°C and 100% load :		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
20	Efficiency at 75°C and 75% load :		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
21	Efficiency at 75°C and 50% load :		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
22	Efficiency at 75°C and 25% load :		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
23	Regulation at full load :		
	a) at 1.0 power factor, %	To be mentioned	
	b) at 0.8 power factor, %	To be mentioned	
	Transformer Oil :		
24	a) Type of oil	Mineral Insulating Oil	
	b) Manufacturer's Name & Address	To be mentioned	
25	Total weight of oil, Kg	To be mentioned	
26	Breakdown Voltage at 2.5mm gap between electrodes	> 50 kV	
	Transformer Core :		
27	Manufacturer's Name & Address	To be mentioned	
28	Total weight of core, Kg	To be mentioned	
29	Material of core & grading	To be mentioned	
30	Core Loss/ Kg, supported by Characteristic Curve& Core Manufacturer's Brochure	To be mentioned	
31	Thickness of core, mm	To be mentioned	
32	Core Dia, mm	To be mentioned	
33	Max. magnetic flux density, Tesla	< 1.7	
	Transformer Windings :		
34	Copper Conductor's Manufacturer Name & Address	To be mentioned	
35	Material of windings	copper	
36	Winding resistance of :		
	a) H.T. winding, Ohm. (per phase at 75° C)	To be mentioned	

Sl. No.	Description	BPDB'S Requirement	Manufacturer's Guaranteed Data
	b) L.T. winding, milli-Ohm. (per phase at 75^{o} C)	To be mentioned	
37	Current density of :		
	a) H.T. winding, Amps/sq. mm	To be mentioned	
	b) L.T. winding, Amps/sq. mm	To be mentioned	
38	Outer, Inner & Mean dia of copper winding:		
	a) H.T. winding, mm	To be mentioned	
	b) L.T. winding, mm	To be mentioned	
39	Size of Copper Conductor :		
	a) H.T. winding SWG, dia. in mm & area in mm^2	To be mentioned	
	b) L.T. winding SWG, area in mm^2	To be mentioned	
40	Number of Turns :		
	a) HT winding, nos.	To be mentioned	
	b) LT winding, nos.	To be mentioned	
41	Copper weight of windings :		
	a) HT winding, Kg	To be mentioned	
	b) LT winding, Kg	To be mentioned	
42	Total weight of copper windings, Kg	To be mentioned	
43	Dimension of Transformer :		
	a) Width, mm(supported by type test report)	To be mentioned	
	b) Length, mm(supported by type test report)	To be mentioned	
	c) Height, mm(supported by type test report)	To be mentioned	
	d) Tank Sheet thickness of top, bottom & side, mm	To be mentioned	
	e) Total weight of transformer tank, Kg	To be mentioned	
44	a) Total weight of active part (core, coil and other accessories), Kg	To be mentioned	
	b) Total weight of complete Transformer including fittings & oil, Kg	To be mentioned	
45	Type of breathings	To be mentioned	
46	Name of relevant IEC or other Equivalent Standards for Design, manufacture, testing and performance.	To be mentioned	
47	Drawing :		
	a) General Arrangement & Outline Dimensions	To be submitted	
	b) Internal Construction Details/ Sectional drawing of active parts including Insulation arrangement	To be submitted	
	c) HT & LT Bushings with dimension & current ratings	To be submitted	
	d) Cross-section &Dimensional drawing of Core & Windings	To be submitted	
	e) Radiator with detail dimensional drawing	To be submitted	
	f) Tap changer with dimension & current ratings.	To be submitted	
48	Routine Test Report :		

Sl. No.	Description	BPDB'S Requirement	Manufacturer's Guaranteed Data	
	a) Measurement of turn ratio test.	To be submitted		
	b) Vector group test.	To be submitted		
	c) Measurement of winding resistance.	To be submitted		
	d) Measurement of insulation resistance.	To be submitted		
	e) Measurement of no load loss & no-load current.	To be submitted		
	f) Measurement of impedance voltage & load loss.	To be submitted		
	g) Dielectric withstands Tests.	To be submitted		
	h) Transformer oil test (including Tan delta).	To be submitted		
49	Type Tests report along with details test result and drawings for 33/0.415KV, 200KVA, 3-Phase, Dyn11 Distribution Transformer from an independent testing Laboratory/ Institute as per IEC 60076.			
	a) Impulse Voltage Withstands test.	To be submitted		
	b) Temperature Rise test.	To be submitted		
50	Short-circuit Tests Report for the offered 33/0.415KV, 200KVA, 3-Phase, Dyn11 Distribution Transformer as per relevant IEC with detail test results & drawings from reputed independent testing Laboratory/ Institution or detail calculation on the basis of design data by the manufacturer.	To be submitted		
51.	Manufacturer must comply all the features of Technical Specification (Section 7)	Yes		

Manufacturer's Seal & Signature **Bidder Seal & Signature**

8.19 Guaranteed Technical Particulars for Single-Core, 800 mm^2 33 kV XLPE Insulated Copper Cable

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, Otherwise bid shall be rejected. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		1CX800 mm^2 33 kV XLPE Insulated Copper Cables	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		Performance, Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5.	Country of Origin		Shall be mentioned	
6.	VOLTAGE Voltage between phases of three Phase circuit U U_{max}	 kV kV	 33 36	
7.	CORES Number of Cores	 No.	 one	
8.	Manufacturing Process		CCV/VCV	

9.	CONDUCTOR material cross sectional area Min. No. &Dia of wires	 mm^2 Nos./mm	 Electrolytic annealed copper 800 91/ To be mentioned	
10.	CONDUCTOR SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting XLPE 0.8 To be mentioned	
11.	INSULATION Material Type of dry curing Nominal Thickness Diameter of over Insulation	 mm mm	 XLPE Inert gas 8.0 To be mentioned	
12.	CORE SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting XLPE 0.5 To be mentioned	
13	METALLIC SCREEN Number and diameter of copper screen strands or Copper Wire with helically applied Copper Tape	 No./mm or No./mm with Thickness of tape	 Based on Design Calculation	
14.	SEPARATION SHEATH Material		 To be Mentioned	

	Thickness of bedding	mm	1.6	
15.	Armour ARMOUR Number & diameter of aluminum wire or Thickness of Corrugated Aluminum sheath	No./mm or mm	Based on Design Calculation	
16.	OUTER COVERING Material Minimum average thickness	 mm	 Black extruded MDPE 2.8	
17.	COMPLETED CABLE Overall diameter Weight per metre Maximum drum length	 mm kg m	 To be mentioned 9.8 500	
18.	CABLE DRUMS Material Overall diameter Width Gross weight (with cable)	 mm m kg	 Steel To be mentioned To be mentioned To be mentioned	
19.	CONTINUOUS CURRENT CARRYING CAPACITY Based on the conditions specified: One circuit Two circuits Three circuits In Air	 A A A A	 950 787 685 1240	

	One circuit			
20.	PERMISSIBLE OVERLOAD In Service Conditions For a period of	 % Hours	 To be mentioned To be mentioned	
21.	MAXIMUM CONDUCTOR TEMPERATURE Laid direct in ground Drawn into ducts Erected in air	 °C °C °C	 90 90 90	
22.	CONDUCTOR SHORT CIRCUIT CURRENT Carrying capacity for one second, Cable load as above prior to Short circuit and final conductor Temperature of 250°C`	 KA	 114.4	
23.	METALLIC LAYER/SHEATH EARTH FAULT CURRENT Carrying capacity for one second, Cable loaded as above prior to Earth fault	 KA	 40(with detail calculation)	
24.	MINIMUM RADIUS OF BEND Around which cable can be laid	 m	20 times of overall diameter of cable	
25.	MAXIMUM DC RESISTANCE Per km of cable at 20°C of conductor of metallic layer	 ohm ohm	 0.0221 To be mentioned	
26.	MAXIMUM AC RESISTANCE			

	Of conductor per km of cable at Maximum conductor temperature	 ohm	 0.051	
27..	INSULATION RESISTANCE Per km of cable per core at 20°C at maximum rated temperature	 Megohm Megohm	 400 40	
28.	EQUIVALENT STAR REACTANE Per km of 3 phase circuit at Nominal frequency	 Ohm/Km	 0.103	
29.	MAXIMUM ELECTROSTATIC CAPACITANCE Per Km of cable	 µF	 0.307	
30.	MAXIMUM INDUCED VOLTAGE On metallic layer/sheath Under fault condition	 V	 To be mentioned	
31.	MAXIMUM CHARGING CURRENT Per core per metre of cable at Nominal voltage Uo	 mA	 To be mentioned	
32.	MAXIMUM DIELECTIC LOSS Of cable per metre of 3 phase circuit when laid direct in the ground at nominal voltage Uo and normal frequency at maximum conductor Temperature	 W/m	 0.33	

33.	METALLIC SHEATH LOSS Of cable per metre of 3 phase circuit, At nominal voltage Uo, normal frequency And at the specified current rating	W	To be mentioned	
34.	MAXIMUM PULLING TENSION	kg	To be mentioned	
35.	Manufacturer must comply all the features of Technical Specification (Section 7) .		Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.19 Guaranteed Technical Particulars of Single-Core, 500 mm^2 33 kV XLPE Insulated Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	1CX500 mm^2 33 kV XLPE Insulated Copper Cables	
2	Manufacturer's name & address With website, official domain email.	-	To be mentioned	
3	Year of Manufacturing	Yr.	Not before 2022	
4	Standard	-	Performance, Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5.	Country of Origin	-	Shall be mentioned	
6.	VOLTAGE Voltage between phases of three Phase circuit U U_{max}	 kV kV	 33 36	
7.	Manufacturing Process		CCV/VCV	
8.	CORES Number of Cores	 No.	 one	
9.	CONDUCTOR material cross sectional area Min. No. & Dia of wires	 mm^2 Nos./mm	 Electrolytic annealed copper 500 61/ To be mentioned	
10.	CONDUCTOR SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting XLPE 0.8 To be mentioned	
11.	INSULATION Material		 XLPE	

	Type of dry curing Nominal Thickness Diameter of over Insulation	 mm mm	Inert gas 8.0 To be mentioned	
12.	CORE SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting XLPE 0.5 To be mentioned	
13.	METALLIC SCREEN Number and diameter of copper screen strands or Copper Wire with helically applied Copper Tape	No./mm or No./mm with Thickness of tape	 Based on Design Calculation	
14.	SEPARATION SHEATH Material Thickness of bedding	 mm	 To be mentioned 1.6	
15.	ARMOUR Number & diameter of amour wire or Thickness of Corrugated Aluminum sheath	 No./mm or mm	 Based on Design Calculation	
16.	OUTER COVERING Material Minimum average thickness	 mm	 Black extruded MDPE 2.6	
17.	COMPLETED CABLE Overall diameter Weight per metre Maximum drum length	 mm kg m	 52 6.2 500	
18.	CABLE DRUMS Material Overall diameter Width Gross weight (with cable)	 mm m kg	 Steel To be mentioned To be mentioned To be mentioned	
19.	CONTINUOUS CURRENT CARRYING CAPACITY Based on the conditions specified: One circuit Two circuits Three circuits In Air One circuit	 A A A A	 702 579 504 877	

20.	PERMISSIBLE OVERLOAD In Service Conditions For a period of	 % Hours	 To be mentioned To be mentioned	
21.	MAXIMUM CONDUCTOR TEMPERATURE Laid direct in ground Drawn into ducts Erected in air	 °C °C °C	 90 90 90	
22.	CONDUCTOR SHORT CIRCUIT CURRENT Carrying capacity for one second, Cable load as above prior to Short circuit and final conductor Temperature of 250°C`	KA	71.5	
23.	METALLIC LAYER/SHEATH EARTH FAULT CURRENT Carrying capacity for one second, Cable loaded as above prior to Earth fault	KA	40 (with detail calculation)	
24.	MINIMUM RADIUS OF BEND Around which cable can be laid	 m	20 times of overall diameter of cable	
25.	MAXIMUM DC RESISTANCE Per km of cable at 20°C of conductor of metallic layer	 ohm ohm	 0.0366 To be mentioned	
26.	MAXIMUM AC RESISTANCE Of conductor per km of cable at Maximum conductor temperature	 ohm	 0.051	
27.	INSULATION RESISTANCE Per km of cable per core at 20°C at maximum rated temperature	 Megohm Megohm	 400 40	
28.	EQUIVALENT STAR REACTANE Per km of 3 phase circuit at Nominal frequency	 Ohm/K m	 0.122	
29.	MAXIMUM ELECTROSTATIC CAPACITANCE Per Km of cable	 µF	 0.307	
30.	MAXIMUM INDUCED VOLTAGE On metallic layer/sheath Under fault condition	 V	 To be mentioned	

31.	MAXIMUM CHARGING CURRENT Per core per metre of cable at Nominal voltage Uo	mA	To be mentioned	
32.	MAXIMUM DIELECTIC LOSS Of cable per metre of 3 phase circuit when laid direct in the ground at nominal voltage Uo and normal frequency at maximum conductor Temperature	W/m	0.33	
33.	METALLIC SHEATH LOSS Of cable per metre of 3 phase circuit, At nominal voltage Uo, normal frequency And at the specified current rating	W	To be mentioned	
34.	MAXIMUM PULLING TENSION	kg	3500 Kg	
35	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.20 Guaranteed Technical Particulars of 11kV, XLPE, 3C x 185mm^2 COPPER CABLE

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	3C x185 mm^2 11 kV XLPE Insulated Copper Cables	
2	Manufacturer's name & address With website, official domain email.	-	To be mentioned	
3	Year of Manufacturing	Yr.	Not before 2022	
4	Standard	-	Performance, Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
	Country of Origin	-	To be mentioned	
5.	VOLTAGE Voltage between phases of three Phase circuit U U_{max}	 kV kV	 11 12	
6.	CORES Number of Cores	 No.	 Three	
	Manufacturing Process		To be mentioned	
7.	CONDUCTOR material cross sectional area Min. No. & Dia of wires	 mm^2 Nos./mm	 Electrolytic annealed copper 185 37/ To be mentioned	
8.	CONDUCTOR SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting XLPE 0.5 To be mentioned	
9.	INSULATION			

	Material Type of dry curing Nominal Thickness Diameter of over Insulation	 mm mm	XLPE Inert gas 3.4 To be mentioned	
10.	CORE SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting XLPE 0.5 To be mentioned	
11.	METALLIC SCREEN Number and diameter of copper screen strands or Copper Wire with helically applied Copper Tape	 No./mm or No./mm with Thickness of tape	 Based on Design Calculation	
12.	INNER JACKET Material Nominal Thickness External diameter	 mm mm	 PVC 1.7 To be mentioned	
13.	ARMOUR Number & diameter of amour wire or Thickness of Corrugated Aluminium sheath	 No./mm or mm	 Based on Design Calculation	
14.	OUTER COVERING Material Minimum average thickness	 mm	 Black extruded MDPE 3.1	
15.	COMPLETED CABLE Overall diameter Weight per metre Maximum drum length	 mm kg m	 64 7.8 250	
16.	CABLE DRUMS Material Overall diameter Width Gross weight (with cable)	 mm m kg	 Steel To be mentioned To be mentioned To be mentioned	
17.	CONTINUOUS CURRENT CARRYING CAPACITY Based on the conditions specified: One circuit Two circuits Three circuits In Air	 A A A	 403 329 285	

	One circuit	A	440	
18.	PERMISSIBLE OVERLOAD In Service Conditions For a period of	 % Hours	 To be mentioned To be mentioned	
19.	MAXIMUM CONDUCTOR TEMPERATURE Laid direct in ground Drawn into ducts Erected in air	 °C °C °C	 90 90 90	
20.	CONDUCTOR SHORT CIRCUIT CURRENT Carrying capacity for one second, Cable load as above prior to Short circuit and final conductor Temperature of 250°C`	KA	26.5	
21.	METALIC SCREEN EARTH FAULT CURRENT Carrying capacity for one second, Cable loaded as above prior to Earth fault	KA	25 (with detail calculation)	
22.	MINIMUM RADIUS OF BEND Around which cable can be laid	m	20 times of overall diameter of cable	
23.	MAXIMUM DC RESISTANCE Per km of cable at 20°C of conductor of metallic layer	 ohm ohm	 0.0.0991 To be mentioned	
24.	MAXIMUM AC RESISTANCE Of conductor per km of cable at Maximum conductor temperature	ohm	0.129	
25.	INSULATION RESISTANCE Per km of cable per core at 20°C at maximum rated temperature	 Megohm Megohm	 400 40	
26.	EQUIVALENT STAR REACTANE Per km of 3 phase circuit at Nominal frequency	Ohm/Km	0.103	
27.	MAXIMUM ELECTROSTATIC CAPACITANCE Per Km of cable	µF	0.412	
28.	MAXIMUM INDUCED VOLTAGE On metallic layer/sheath	V	To be mentioned	

	Under fault condition			
29.	MAXIMUM CHARGING CURRENT Per core per metre of cable at Nominal voltage Uo	mA	To be mentioned	
30.	MAXIMUM DIELECTIC LOSS of cable per metre of 3 phase circuit when laid direct in the ground at nominal voltage Uo and normal frequency at maximum conductor Temperature	W/m	0.44	
31.	METALLIC SHEATH LOSS Of cable per metre of 3 phase circuit, At nominal voltage Uo, normal frequency And at the specified current rating	W	To be mentioned	
32.	MAXIMUM PULLING TENSION	kg	1295 Kg	
33	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.21 Guaranteed Technical Particulars of Termination Kit all type XLPE COPPER CABLE

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

(A) Straight-through joint box for 33KV XLPE, 1-Core, 500 mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors	
ii	Installation	For underground horizontal mounting	
iii	System	33KV, effectively earthed system	
iv	Cable conductor	500 mm^2 1-core, Copper Conductors	
v	Construction	The joint shall be proof against ingress of moisture and water	
vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions	-

(B) Indoor Termination Kits for 33KV, XLPE, 1-Core, 500 mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors	
ii	Installation	For Indoor switchgear terminations	
iii	System	33KV, effectively earthed system	
iv	Cable conductor	500 mm^2 1-core, Copper Conductors	
v	Kit content	- Heat shrinkable high voltage insulating and non- tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Installation instructions	-

(C) Outdoor Termination Kits for 33KV, XLPE, 1-Core, 500 mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 33KV, 1-core, XLPE 500 mm^2 Copper Conductors	
ii	Installation	For outdoor installation on poles/structures	
iii	System	33KV, effectively earthed system	
iv	Cable conductor	500 mm^2 1-core Copper Conductors	
v	Kit content	- Heat shrinkable high voltage insulating and non- tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit	-

		- Solderless earth connection kit - Compression lugs for 500 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions	

(D) Straight-through joint box for 33KV XLPE, 3-Core, 95 mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 33KV, 3-core, XLPE 95 mm^2 Copper Conductors	
ii	Installation	For underground horizontal mounting	
iii	System	33KV, effectively earthed system	
iv	Cable conductor	95 mm^2 3-core, Copper Conductors	
v	Construction	The joint shall be proof against ingress of moisture and water	
vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions	-

(E) Indoor Termination Kits for 33KV, XLPE, 3-Core, 95 mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 33KV, 3-core, XLPE 95mm^2 Copper Conductors	
ii	Installation	For Indoor switchgear terminations	
iii	System	33KV, effectively earthed system	
iv	Cable conductor	95 mm^2 3-core, Copper Conductors	
v	Kit content	- Heat shrinkable high voltage insulating and non- tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3X95 mm^2 Copper Conductors - Installation instructions	-

(F) Outdoor Termination Kits for 33KV, XLPE, 3-Core, 95mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 33KV, 3-core, XLPE 95 mm^2 Copper Conductors	
ii	Installation	For outdoor installation on poles/structures	
iii	System	33KV, effectively earthed system	
iv	Cable conductor	95 mm^2 3-core Copper Conductors	
v	Kit content	- Heat shrinkable high voltage insulating and non- tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator	-

		- Cable preparation kit - Solderless earth connection kit - Compression lugs for 3X95 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions	

(J) Straight-through joint box for 11KV XLPE, 3-Core, 185 mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 11KV, 3-core, XLPE 185 mm^2 Copper Conductors	
ii	Installation	For underground horizontal mounting	
iii	System	11KV, effectively earthed system	
iv	Cable conductor	185 mm^2 3-core, Copper Conductors	
v	Construction	The joint shall be proof against ingress of moisture and water	
vi	Kit content	- Compression ferrules - Valid filling tape - Heat shrinkable stress control tubing - Truck resistant sealant tape - Heat shrinkable high voltage insulating tape - Heat shrinkable black/red dual wall - Estomeric tube - Roll spring - Heat shrinkable outer jacket tube - Cable preparation kit - Solderless earth connection kit - Misc. other material - Installation instructions	-

(K) Indoor Termination Kits for 11KV, XLPE, 3-Core, 185mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 11KV, 3-core, XLPE 185mm^2 Copper Conductors	
ii	Installation	For Indoor switchgear terminations	
iii	System	11KV, effectively earthed system	
iv	Cable conductor	185 mm^2 3-core, Copper Conductors	
v	Kit content	- Heat shrinkable high voltage insulating and non- tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Cable preparation kit - Solderless earth connection kit - Compression lugs for 3x185 mm^2 Copper Conductors - Installation instructions	-

(L) Outdoor Termination Kits for 11KV, XLPE, 3-Core, 185mm^2 Copper cable

Item No.	Description of Items	Purchaser's Requirement	Manufacturer's Particulars
i	Application	For 11KV, 3-core, XLPE 185 mm^2 Copper Conductors	
ii	Installation	For outdoor installation on poles/structures	
iii	System	11KV, effectively earthed system	
iv	Cable conductor	185 mm^2 3-core Copper Conductors	
v	Kit content	- Heat shrinkable high voltage insulating and non- tracking tubing - Heat shrinkable stress control tubing - Stress relieving mastic strip - Truck resistant sealant tape - Heat shrinkable truck resistant rain skirt - Support insulator - Cable preparation kit	-

		- Solderless earth connection kit - Compression lugs for 3x180 mm^2 Copper Conductors - Support insulators Tee Brackets - Installation instructions	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.22 GUARANTEED TECHNICAL PARTICULARS FOR Three-Core, 95 mm^2 33 kV XLPE INSULATED COPPER CABLES

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		3CX95mm^2 11kV XLPE Insulated Copper Cables	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard		Performance, Design and Testing shall be in accordance to the BS, IEC, BDS or Equivalent International Standard.	
	Country of Origin		To be mentioned	
5	VOLTAGE Voltage between phase of three Phase circuit U U_{max}	 kV kV	 11 12	
	Manufacturing Process		CCV/VCV	
6	CORES Number of Cores	 No.	 Three	
7	CONDUCTOR Material Cross Sectional Area Min. No. & Diameter of Wires	 mm^2 Nos./mm	 Electrolytic Annealed Copper 95 15/To be mentioned	
8	CONDUCTOR SCREEN Material Nominal Thickness Diameter over Screen	 mm mm	 Semi-Conducting XLPE 0.80 To be mentioned	
9	INSULATION Material Type of Dry Curing Nominal Thickness Diameter over Insulation	 mm mm	 XLPE Inert Gas 8.00 To be mentioned	
10	INSULATION SCREEN Material Nominal Thickness Diameter over Screen	 mm mm	 Semi-Conducting XLPE 0.50 To be mentioned	
11	METAL SCREEN Number and Diameter of Copper Screen Strands Or	 No./mm	 Based on Design Calculation	

	Copper Wire with Helically Applied Copper Tape	No./mm	Based on Design Calculation	
12	SEPARATION SHEATH Material Thickness of Bedding	 mm	 To be mentioned 1.80	
13	ARMOUR Number & Diameter of Armour Wire Or Thickness of Corrugated Aluminum Sheath	 No./mm mm	 Based on Design Calculation Based on Design Calculation	
14	OUTER COVERING Material Minimum Average Thickness	 mm	 Black Extruded MDPE 3.10	
15	COMPLETED CABLE Overall Diameter Weight per Meter Maximum Drum Length	 mm kg m	 92.90 10.05 500	
16	CABLE DRUMS Material Overall Diameter Width Gross Weight (with cable)	 mm mm kg	 Steel To be mentioned To be mentioned To be mentioned	
17	CONTINUOUS CURRENT CARRYING CAPACITY Based on the conditions specified: One Circuit Two Circuit Three Circuit In Air: One Circuit	 A A A A	 239 191 165 279	
18	PERMISSIBLE OVERLOAD In Service Conditions For a period of	 % Hours	 To be mentioned To be mentioned	
19	MAXIMUM CONDUCTOR TEMPERATURE Laid Direct in Ground Drawn into Ducts Erected in Air	 °C °C °C	 90 90 90	
20	CONDUCTOR SHORT CIRCUIT CURRENT Carrying Capacity for One Second, Cable Load as above prior to Short Circuit and Final Conductor Temperature of 250°C	 kA	 13.59	
21	METALLIC LAYER/SHEATH EARTH FAULT CURRENT Carrying Capacity for One Second, Cable Loaded as above prior to Earth Fault	 kA	 Min. 40 (with detail calculation)	
22	MINIMUM RADIUS OF BEND Around which Cable can be Laid	 m	 15 times of overall diameter of cable	
23	MAXIMUM DC RESISTANCE Per km of Cable at 20°C:			

	of Conductor of Metallic Layer	ohm ohm	0.193 To be mentioned	
24	MAXIMUM AC RESISTANCE Of Conductor per km of Cable at Maximum Conductor Temperature	ohm	0.247	
25	INSULATION RESISTANCE Per km of Cable per Core: At 20°C At Maximum Rated Temperature	Megohm Megohm	400 40	
26	EQUIVALENT STAR REACTANCE Per km of 3 Phase Circuit at Nominal Frequency	ohm/km	0.128	
27	MAXIMUM ELECTROSTATIC CAPACITANCE Per km of Cable	µF	0.165	
28	MAXIMUM INDUCED VOLTAGE On Metallic Layer/Sheath Under Fault Condition	V	To be mentioned	
29	MAXIMUM CHARGING CURRENT Per Core per Meter of Cable at Nominal Voltage U_0	mA	To be mentioned	
30	MAXIMUM DIELECTRIC LOSS Of Cable per Meter of 3 Phase Circuit when Laid Direct in the Ground at Nominal voltage U_0 and Nominal Frequency at Maximum Conductor Temperature	W/m	0.0748	
31	METALLIC SHEATH LOSS Of Cable per Meter of 3 Phase Circuit, At Nominal Voltage U_0, Normal Frequency and at the Specified Current Rating	W	To be mentioned	
32	MAXIMUM PULLING TENSION	kg	To be mentioned	
33	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.23 Guaranteed Technical Particulars for Single-Core, 630 mm^2 11 kV XLPE Insulated Copper Cable

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, Otherwise bid shall be rejected. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer 's Particulars
1	Name of the Item		1CX630 $mm^2$11 kV XLPE Insulated Copper Cables	
2	a) Manufacturer's name & address with website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard		Performance, Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5.	Country of Origin			
6.	VOLTAGE Voltage between phases of three Phase circuit U U_{max}	 kV kV	 11 12	
7.	Manufacturing Process		CCV/VCV	
8.	CORES Number of Cores	 No.	 one	
9.	CONDUCTOR material cross sectional area Min. No. & Dia of wires	 mm^2 Nos./m m	Electrolytic annealed copper 630 61/ To be mentioned	
10.	CONDUCTOR SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting 0.8 To be mentioned	
11.	INSULATION Material Type of dry curing Nominal Thickness Diameter of over Insulation	 mm mm	 XLPE Inert gas 3.8 To be mentioned	

12.	INSULATION SCREEN Material Nominal Thickness Diameter over screen	 mm mm	 semi-conducting 0.5 To be mentioned	
13.	METALLIC SCREEN Number and diameter of copper screen strands or Copper Wire with helically applied Copper Tape	 No./mm or No./mm with Thickness of tape	 Based on Design Calculation	
14.	SEPARATION SHEATH Material Thickness of bedding	 mm	 To be mentioned 1.2	
15.	ARMOUR Number & diameter of amour wire or Thickness of Corrugated Aluminium sheath	 No./mm or mm	 Based on Design Calculation	
16.	OUTER COVERING Material Minimum average thickness	 mm	 Black extruded MDPE 2.5	
17.	COMPLETED CABLE Overall diameter Weight per metre Maximum drum length	 mm kg m	 To be mentioned 7.0 500	
18.	CABLE DRUMS Material Overall diameter Width Gross weight (with cable)	 mm m kg	 Steel To be mentioned To be mentioned To be mentioned	
19.	CONTINUOUS CURRENT CARRYING CAPACITY Based on the conditions specified: One circuit Two circuits Three circuits In Air One circuit	 A A A A	 695 564 487 858	
20.	PERMISSIBLE OVERLOAD In Service Conditions For a period of	 % Hours	 To be mentioned To be mentioned	
21.	MAXIMUM CONDUCTOR			

	TEMPERATURE Laid direct in ground Drawn into ducts Erected in air	 °C °C °C	 90 90 90	
22.	CONDUCTOR SHORT CIRCUIT CURRENT Carrying capacity for one second, Cable load as above prior to Short circuit and final conductor Temperature of 250°C`	KA	71.5	
23.	METALIC SCREEN EARTH FAULT CURRENT Carrying capacity for one second, Cable loaded as above prior to Earth fault	KA	25 (with detail calculation)	
24.	MINIMUM RADIUS OF BEND Around which cable can be laid	m	20 times of overall diameter of cable	
25.	MAXIMUM DC RESISTANCE Per km of cable at 20°C of conductor of metallic layer	ohm	0.0366	
26.	MAXIMUM AC RESISTANCE Of conductor per km of cable at Maximum conductor temperature	ohm	0.053	
27.	INSULATION RESISTANCE Per km of cable per core at 20°C at maximum rated temperature	 Megohm Megohm	 400 40	
28.	EQUIVALENT STAR REACTANE Per km of 3 phase circuit at Nominal frequency	Ohm/Km	0.102	
29.	MAXIMUM ELECTROSTATIC CAPACITANCE Per Km of cable	µF	0.628	
30.	MAXIMUM INDUCED VOLTAGE On metallic layer/sheath Under fault condition	V	To be mentioned	
31.	MAXIMUM CHARGING CURRENT			

	Per core per meter of cable at Nominal voltage Uo	mA	To be mentioned	
32.	MAXIMUM DIELECTIC LOSS Of cable per meter of 3 phase circuit when laid direct in the ground at nominal voltage Uo and normal frequency at maximum conductor Temperature	W/m	0.33	
33.	METALLIC SHEATH LOSS Of cable per meter of 3 phase circuit, At nominal voltage Uo, normal frequency And at the specified current rating	W	To be mentioned	
34.	MAXIMUM PULLING TENSION	kg	To be mentioned	
35.	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.24 GUARANTEED TECHNICAL PARTICULARS FOR FOUR CORE, 120 mm² PVC INSULATED AND PVC SHEATHED COPPER CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		4CX120 sq. mm PVC Insulated and PVC Sheathed Cables	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard		Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm²	4CX120	
6	Material	-	PVC Insulated and PVC Sheathed plain annealed copper	
7	Numbers & Diameter of wires	mm	Min. 30 Wires	
8	Shaped of conductor	-	Sector Shaped	
9	Maximum resistance at 30°C	Ω/km	0.1010	
10	Nominal thickness of insulation	mm	2.00	
11	Colour of insulation	-	Red, Yellow, Blue, Black	
12	Nominal thickness of inner	mm	1.60, Black	

	sheath			
13	Nominal thickness of sheath	mm	2.80	
14	Colour of sheath	-	Black	
15	Approximate Outer-diameter	mm	56.30	
16	Approximate weight	kg/km	8725	
17	Continuous permissible service voltage	V	600/1000	
17	Current rating at 30°C ambient temperature in U/G	Amps	330	
18	Current rating at 35°C ambient temperature in air	Amps	350	
20	Drum wound length	M	500	
21	Net Weight	kg	Shall be mentioned	
22	Gross weight	kg	Shall be mentioned	
23	Treated Wooden Drum Standard		AWPA C_1-82, C_2-83, C_{16}-82, P_5-83	
24	Manufacturer must comply all the features of Technical Specification (Section 7)		Yes	

Seal and Signature of the Manufacture: **Seal and Signature of the Bidder:**

8.25 Guaranteed Technical Particulars of Single-Core, 150 mm^2 PVC Insulated and PVC Sheathed Copper Cable.

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	1C x 150 sq. mm PVC Insulated and PVC Sheathed Cables	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	1C x 150	
6	Material	-	PVC Insulated and PVC Sheathed plain annealed copper.	
7	Numbers & Diameter of wires	Mm	Min 18 Wires	
8	Maximum DC resistance at 30 deg. C	Ω/KM	0.124	
9	Nominal thickness of insulation	Mm	1.8	
10	Nominal thickness of sheath	Mm	1.8	
11	Colour of sheath		Black	
12	Approximate outer diameter	Mm	21.9	
13	Approximate weight	Kg/KM	1640	
14	Continuous permissible service voltage	V	600/1000	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	350	
16	Current rating at 35 deg. C ambient in air	Amps	405	
17	Drum wound length	M	500	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.26 Guaranteed Technical Particulars of Single-Core, 120 mm^2 PVC Insulated and PVC Sheathed Copper Cable for grounding system

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	1C x 120 sq. mm PVC Insulated and PVC Sheathed Cables	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	1C x 120	
6	Material	-	PVC Insulated and PVC Sheathed plain annealed copper.	
7	Numbers & Diameter of wires	Mm	Min 18 Wires	
8	Maximum resistance at 30 deg. C	Ω/KM	0.153	
9	Nominal thickness of insulation	Mm	1.6	
10	Nominal thickness of sheath	Mm	1.8	
11	Color of sheath		Black	
12	Approximate outer diameter	Mm	20.0	
13	Approximate weight	Kg/KM	1340	
14	Continuous permissible service voltage	V	600/1000	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	310	
16	Current rating at 35 deg. C	Amps	350	

	ambient in air			
17	Drum wound length	M	500	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer

Seal and Signature of the Bidder

8.27 Guaranteed Technical Particulars of 4CX2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	4C x 2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable with Armouring	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	4CX2.5 mm^2	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	1.4	
9	Thickness of Steel Tape	mm	To be mentioned	
10	Maximum resistance at 30 deg. C	Ω/KM	7.28	
11	Nominal thickness of insulation	mm	0.8 (min.)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath		Black	
14	Colour of Core		Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	17	
16	Approximate weight	Kg/KM	670	
17	Drum wound length	M	1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82,	

			P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.28 Guaranteed Technical Particulars of 4CX6 mm^2 PVC Insulated and PVC Sheathed Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	4Cx6 mm^2 PVC Insulated and PVC Sheathed Copper Cable with Armouring	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	4Cx6 mm^2	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/1.04	
8	Numbers & Diameter of Steel wires	mm	4x0.8	
9	Nominal size of Steel Tape	mm	0.25	
10	Maximum resistance at 30 deg. C	Ω/KM	3.20	
11	Nominal thickness of insulation	mm	1.0 (min.)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath	-	Black	
14	Colour of Core	-	Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	21	
16	Approximate weight	Kg/KM	920	
17	Drum wound length	M	1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	

20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.29 Guaranteed Technical Particulars of 4Cx4 mm^2 PVC Insulated and PVC Sheathed Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	4Cx4 mm^2 PVC Insulated and PVC Sheathed Copper Cable with Armouring	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	4Cx4 mm^2	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.85	
8	Numbers & Diameter of Steel wires	mm	4x0.8	
9	Nominal size of Steel Tape	mm	0.25	
10	Maximum resistance at 30 deg. C	Ω/KM	1.90	
11	Nominal thickness of insulation	mm	1.0 (min.)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath	-	Black	
14	Colour of Core	-	Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	20	
16	Approximate weight	Kg/KM	810	
17	Drum wound length	M	1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum	-	AWPA C_1 – 82,	

	Standard		C_2 –83, C_{16} –82, P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.30 Guaranteed Technical Particulars of 8Cx2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	8Cx2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable with Armouring	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	8Cx2.5 mm^2	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Numbers & Diameter of Steel wires	mm	4x0.8	
9	Nominal size of Steel Tape	mm	0.25	
10	Maximum resistance at 30 deg. C	Ω/KM	1.19	
11	Nominal thickness of insulation	mm	0.8 (min.)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath	-	Black	
14	Colour of Core	-	Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	24	
16	Approximate weight	Kg/KM	1140	
17	Drum wound length	M	1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	

20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.31 Guaranteed Technical Particulars of 16CX2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	16Cx2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable with Armouring	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	16Cx2.5 mm^2	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Numbers & Diameter of Steel wires	mm	4x0.8	
9	Nominal size of Steel Tape	mm	0.25	
10	Maximum resistance at 30 deg. C	Ω/KM	7.69	
11	Nominal thickness of insulation	mm	0.8 (min.)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath		Black	
14	Colour of Core		Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	25	
16	Approximate weight	Kg/KM	1430	
17	Drum wound length	M	1000	
18	Net Weight	Kg	Shall be mentioned	

19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.32 Guaranteed Technical Particulars of 24Cx2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	24Cx2.5 mm^2 PVC Insulated and PVC Sheathed Copper Cable with Armouring	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
3	Country of Origin		To be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm^2	24Cx2.5 mm^2	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Numbers & Diameter of Steel wires	mm	4x0.8	
9	Nominal size of Steel Tape	mm	0.25	
10	Maximum resistance at 30 deg. C	Ω/KM	7.69	
11	Nominal thickness of insulation	mm	0.8 (min.)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath	-	Black	
14	Colour of Core	-	Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	28	
16	Approximate weight	Kg/KM	1730	
17	Drum wound length	M	1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82,	

			P_5 –83.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.33 Guaranteed Technical Particulars of ACSR MARTIN

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	ACSR MARTIN	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, ASTM, BDS or equivalent International standards.	
5	Installation	-	Overhead	
6	Type	-	Stranded	
7	Material	-	Hard drawn Aluminium steel reinforced	
8	Overall diameter	mm	36.17	
9	Nominal cross sectional area of conductor	mm^2	772.10	
10	Number/diameter of Aluminium Strand	No./mm	54/4.02	
11	Nominal Aluminium cross sectional area	mm^2	685.40	
12	Number/diameter of Steel Strand	No./mm	19/2.41	
13	Nominal Steel cross sectional area	mm^2	86.70	
14	Weight of conductor	Kg/KM	2590	
15	Drum wound length	M	500	
16	Net weight	Kg	Shall be mentioned	
17	Gross weight	Kg	Shall be mentioned	
18	Maximum DC Resistance of Conductor at 20 °C	Ω/KM	0.0425	
19	Minimum breaking Load of Conductor	Kg	min 11400	
20	Maximum working tension of conductor	KN	Shall be mentioned	
21	Current rating at 35ºC rise over 40ºC ambient temperature (75ºC)	Amps.	Shall be mentioned	
22	Practical (final) modulus of elasticity	hbar	7700	
23	Co-efficient of linear expansion	/ºC	shall be mentioned	
24	Aluminum to Steel Ratio		Shall be mentioned	
25	Lay length for Outermost Layer of Aluminium	mm	Shall be mentioned	
26	Lay direction for Outermost Layer of Aluminium	-	Right hand	
27	Lay ratio for Outermost Layer of	-	10-14	

	Aluminium			
28	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 –83, C_{16} –82, P_5 –83.	
29	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.34 Guaranteed Technical Particulars for Disc Insulator

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
01.	Name of the Item	Disc Insulator	
02.	a) Manufacturer's name & address With website, official domain email.	To be mentioned	
	b) Year of Manufacturing	Not before 2022	
	C) Country of Origin	To be mentioned	
03.	Manufacturer's Code No.	To be mentioned	
04.	Standard	Performance, Design and Testing shall be in accordance to the BS, IEC, ASTM, BDS or equivalent International standards.	
05.	Installation	Overhead	
06.	Type	Disc	
07.	Material	Porcelain	
08.	Creepage Distance	292 mm	
09.	Flash over voltage Power Frequency, Dry Power Frequency, Wet	 78 kV 45 kV	
10.	Withstand Voltage Power Frequency, Dry Power Frequency, Wet	 70 kV 40 kV	
11.	Power Frequency Puncture Voltage	110 kV	
12.	50% Impulse flashover Positive	120 kV	
13.	50% Impulse flashover Negative	125 kV	
14.	Mechanical Failing Load	70 KN	
15.	Nominal Diameter	255 mm	
17.	Minimum Spacing	146 mm	
18	Dry Arching Distance minimum	171 mm	
19	Coupling Size	16 mm	
20	Weight in Kg	To be mentioned	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	Yes	

Seal and Signature
of the manufacturer:

Seal and Signature
of the Bidder:

8.35 Guaranteed Technical Particulars of 33 KV Bus bar insulator string

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Manufacturer's model no.	-	To be mentioned	
3	Insulator material	-	Porcelain	
4	Number of units per string	Nos.	4	
5	Insulator Voltage Class	KV	15	
6	Insulator Materials		Porcelain	
7	Type of Insulator	-	Ball and socket type disc, security clip made of rod brass alloy.	
8	Creepage/ leakage distance (min.)	mm	298	
9	Total creepage distance of string	mm	850	
10	Unit Spacing	mm	146	
11	Dry Arcing distance (minimum)	mm	1968	
12	Diameter of Insulator	mm	256	
13	Withstand Voltage, Minimum : a) Power Frequency, dry (one min.) b) Power Frequency, wet (one min.) c) Impulse 1.2/50 µ sec	 KV KV KV	 70 40 110	
14	Flashover Voltage, Minimum : a) Power Frequency, dry b) Power Frequency, wet c) 50% Impulse 1.2/50 µ sec wave, positive or impulse 1.2/50 µsec wave positive. d) 50% Impulse 1.2/50 µ sec wave Negative	 KV KV KV KV	 80 50 125 130	
15	Power Frequency Puncture Voltage, minimum	KV	110	
16	Radio Influence Voltage Data, minimum a) Power frequency test voltage RMS to Ground b) Maximum RIV at 1,000 Kc	 KV µV	 10 50	

17	Minimum Mechanical Strength for Suspension :			
	a) Electro-mechanical Breaking Load	Kg	7260	
	b) Mechanical Breaking load	Kg	6800	
	c) Tension Proof Test Load	Kg	3400	
	d) Time Load Test Value	Kg	4536	
	e) Mechanical Impact Strength	mm Kg	630	
18	Minimum Mechanical Strength for Strain Stringing :			
	a) Electro-mechanical Breaking Load	Kg	11340	
	b) Mechanical Breaking load	Kg	11340	
	c) Tension Proof Test Load	Kg	3400	
	d) Time Load Test Value	Kg	4536	
	e) Mechanical Impact Strength	mm Kg	530	
19	Insulator Hardware	-	Insulator hardware for insulator strings or bus-support such shall have UTS-120 KN and galvanized as per BS-729 OR ASTM A-153.	
20	Standard	-	AS per latest editions of IEC-383.	
21	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature
ofthe Manufacturer

Seal & Signature
of the Bidder

8.36 Guaranteed Technical Particulars for H-Type Connector

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
Compatible for ACSR MARTIN			
1.	a) Manufacturer's name & address With website, official domain email.	To be mentioned	
	b) Year of Manufacturing	Not before 2022	
	C) Country of Origin	To be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	Design, Testing & Performance shall be in accordance to BS, IEC, BDS, ANSI, ASTM or equivalent international standards.	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	H-Type	
6.	Material	Aluminium	
7.	Minimum Continuous Current rating at 35ºC rise over 40ºC ambient temperature (75ºC)	362 Amps (min).	
8.	Length	112 mm	
9.	Weight of 100 nos. in Kg	Shall be mentioned	
10.	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.37 Guaranteed Technical Particulars for Guy/Earth Wire.

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	Guy/Earth Wire	
2	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
3	Manufacturer's Code No.	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, BDS or equivalent International standards.	
5	Installation	-	Overhead/Stay	
6	Type	-	Stranded, Solid and Bare	
7	Material	-	High Strength Steel	
8	Overall diameter	Mm	9.50	
9	Number/diameter of each strand	No./mm	7/3.15	
10	Nominal cross sectional area of conductors	mm^2	54.53	
11	Weight of Guy Wire	Kg/KM	430	
12	Ultimate Tensile Strength	KN	62.75	
13	Galvanisation	-	As per ASTM B498-74, Class-A	
14	Modulus of Elasticity	Kg/mm^2	19.7×10^3	
15	Coefficient of linear expansion	/ºC	11.3×10^{-6}	
16	Drum wound length	M	1500	
17	Net weight	Kg	Shall be mentioned	
18	Gross weight	Kg	Shall be mentioned	
19	Lay length	Mm	Shall be mentioned	
20	Lay direction	-	Right hand	
21	Lay ratio	-	13-18	
22	Treated Wooden Drum Standard	-	AWPA C_1 – 82, C_2 – 83, C_{16} –82, P_5 –83.	
23	Manufacturer must comply all the	-	Yes	

	features of Technical Specification (Section 7)			

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.38 Guaranteed Technical Particulars for PG Clamp

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
Compatible for ACSR MERTIN to ACSR MERTIN			
1.	a) Manufacturer's name & address With website, official domain email.	To be mentioned	
	b) Year of Manufacturing	Not before 2022	
	C) Country of Origin	To be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	Design, Testing & Performance shall be in accordance to BS, IEC, BDS, ANSI, ASTM or equivalent international standards.	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy	
7.	Minimum Continuous Current rating at 35ºC rise over 40ºC ambient temperature (75ºC)	362 Amps (min).	
8.	Dimension	110 mm x 45 mm	
9.	Weight of 100 nos. in Kg	Shall be mentioned	
10.	Manufacturer must comply all the features of Technical Specification (Section 7)	Yes	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.39 Guaranteed Technical Particulars of Steel Structure Design

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer's guaranteed Particulars
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Maximum ratio of unsupported length of steel compression to their least radius of gyration:			
	a) Main members	mm	120	
	b) Bracing's	mm	180	
	c) Redundant	mm	180	
3	B.S. 4360 grade 43A steel or other approved standard :			
	a) Elastic limit stress in tension members	Kg/mm^2	To be mentioned	
	b) Ultimate stress in compression members (expressed as function L/R)	Kg/mm^2	$Sc=F/S[\{1+0.0001 1x (L/R)^2/ M\}]$	
4	B.S. 4360 grade 50C steel or other approved standard :			
	a) Elastic limit stress in tension members	Kg/mm^2	To be mentioned	
	b) Ultimate stress in compression members (expressed as function L/R)	Kg/mm^2	$Sc=F/S[\{1+0.0001 66 x\{(L/R)^2/M\}]$	
5	Formula for calculation of ultimate stress in compression.	-	$SC=F/S[1+\{LE/\pi^2 E\}x \{(L/R)^2/M\}]$	
	Where,			
	SC = Ultimate stress in compression	Kg/mm^2	To be mentioned	
	F = Yield strength	Kg	To be mentioned	
	S = Section	mm^2	To be mentioned	
	L/R = Length / Radius of gyration	cm	To be mentioned	
	LE = Elastic limit stress	Mg/mm^2	24 or 36	
	E = Elasticity module	Kg/mm^2	22000	
	M = Rigidity Coefficient at each end	-	To be mentioned	
	M=1 with only one bolt at each end of member	-	To be mentioned	
	M=2 with two bolts at each end of a member	-	To be mentioned	
	M=4 if L/R between 110 and 130	-	To be mentioned	
	M=3 if L/R over to 130	-	To be mentioned	
6	Minimum size of member	mm	45 x 45 x --	

7	Weight of each Column	Kg	To be mentioned	
8	Weight of each Girder	Kg	To be mentioned	
9	Total weight	Kg	To be mentioned	
10	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.40 Guaranteed **Technical Particulars of Shield Wire, Earthing Grid and Earthing Electrode**

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	Unit	BPDB's Requirement	Manufacturer 's guaranteed Particulars
A.	SHIELD WIRES			
1	a) Manufacturer's name & address With website, official domain email.	-	To be mentioned	
	b) Year of Manufacturing	Yr.	Not before 2022	
	C) Country of Origin		To be mentioned	
2	Material	-	High Strength Steel	
3	Grade of Steel	Kg	60000	
4	Nos. of Strand	Nos.	7	
5	Diameter of each strand	mm	3.05	
6	Overall diameter	mm	9.525	
7	Nominal cross -section	mm^2	35	
8	Weight per km length	Kg	407	
9	Maximum rated current (3 seconds)	A	To be mentioned	
10	Maximum working tension of main connection	Kg/m^2	To be mentioned	
11	Resistance of conductors per 1000 meters at 20 c	ohms	To be mentioned	
12	Rated Ultimate Tensile Strength	Kg/mm^2	4900	
13	Maximum permissible span length	m	To be mentioned	
14	Maximum sag under own weight of maximum span	mm	To be mentioned	
15	Co-efficient of liner expansion	cm/ ^{0}C.	To be mentioned	
16	Class of Zinc Coating	-	Class-A	
17	Galvanization	-	As per BS-729 OR ASTM A-153	
B.	EARTHING GRID			
1	Manufacturer's name & country	-	To be mentioned	
2	Material	-	Copper	
3	Overall diameter	mm	To be mentioned	
4	Nominal cross -section			
	a) Interconnecting the earth electrodes	mm^2	To be mentioned	
	b) Connecting equipment to mesh	mm^2	To be mentioned	
6	Area of each earthing grid	m x m	To be mentioned	
7	Depth of bedding of conductor	mm	To be mentioned	
8	Maximum earth fault current for 3 sec.	KA	20	
9	Resistance of conductors per 1000 meters at 20^0c	Ohms	To be mentioned	
C.	EARTHING ELECTRODES			

1	Manufacturer's name & country	-	To be mentioned	
2	Material	-	Copper	
3	Dimensions : a) Dia b) Length	 mm mm	 16 4	
4	Number of electrodes per group	-	As per schedule	
5	Number of earthing point per substation	-	To be mentioned	
6	Calculated resistance of combined earth grid and points	ohm	Less than one (1)	
7	Manufacturer must comply all the features of Technical Specification (Section 7)	-	Yes	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.41 Guaranteed Technical Particulars Of Automatic Fire protection and Firefighting system with smoke and heat detectors for 33 kV and 11 kV Switchgear Room

(To be filled up appropriately, then Seal & Signed by both manufacturer and bidder on Manufacturer's Letterhead Pad. Manufacturer & Bidder has to mention only single country of origin as per ITT 6.3 for individual item. Otherwise his bid shall be non-responsive.)

Sl. No.	Description	BPDB's Requirement	Manufacturer's guaranteed Particulars
1	Manufacturer's name & country	To be mentioned	
2	Standard	To be mentioned	
3	Name of accessories and detail BOQ	To be mentioned	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.42 GUARANTEED TECHNICAL PARTICULARS PORTABLE UNDER GROUND AUTOMATIC CABLE FAULT LOCATING EQUIPMENT SUITABLE FOR LOCATING FAULT ON LOW/MEDIUM/HIGH VOLTAGE POWER CABLES UP TO 33 KV CABLE NETWORK

(To be filled up by the bidder/manufacturer with appropriate data, then to be sealed and signed by both tenderer and manufacturer, otherwise the bid will be treated as non-responsive)

Sl. No.	Description	Required BPDB specifications	Manufacturer's Guaranteed Particulars
1.	Name of the Manufacturer	To be mentioned	
2.	Address of the Manufacturer	To be mentioned	
3.	Country of origin	USA/Canada/Europe/Australia/Japan/S. Korea	
4.	Country of manufacture	USA/Canada/Europe/Australia/Japan/S. Korea	
5.	Manufacturer's Model no.	To be mentioned	
6.	Scope	• design, manufacture, assembly, testing, supply, delivery, installation & commissioning of Single-Phase Automatic Cable Fault Locating Equipment Suitable for Locating Fault on Low /Medium / High Voltage Power Cables up to 33 KV Complete with all materials and accessories for efficient and trouble-free operation. • The system should support cable fault location on all types of cables such as XLPE, PVC or PILC with Al/Cu Conductors. It should be suitable for the complete range of cable types and their accessories in all voltage ranges from 415 V to 33kV.Automatic system means single knob operation to control the entire proceedings of cable fault location.	
7.	**Application**	The following functions should be performed and controlled via automatic centrally controlled unit by using single knob or equivalent panel. No manual selection of voltage through selector switch will be allowed. - Integrated Insulation resistance testing - Integrated DC Testing - Pre location of Fault - Pinpointing of Fault - Breakdown Voltage recognition - Sheath Testing	
8.	**Fault pre-location methods**	• TDR – Time Domain Reflectometer • ARM/SIM/MIM Secondary/Multiple Impulse Method up to 32kV • ICM – Impulse Current Method up to 32kV • Decay - Voltage coupled decay method up to 40kV • Optional feature (if any)	

Sl. No.	Description	Required BPDB specifications	Manufacturer's Guaranteed Particulars
9.	**Pin-pointing methods**	• Acoustic pin-pointing • Step voltage method • Cable tracing	
10.	**System software**	The cable fault analysis shall be done automatically via a software controlled fully automatic mega ohmmeter with minimum 20kV IR –test voltage and a powerful TDR. The TDR output must provide at least CAT IV/400V input protection.	
11.	**Functional modules to be provided**	• Central Control Unit/Time Domain reflectometer	
		• Fully Automatic Multi-functional Surge Generator	
		• Mains & Safety Control Unit	
		• LV & HV connector panel	
		• Cable drum rack with connection cables	
		• Operating desk with drawers	
12.	**Pre Locator**		
	TDR pulse width (Minimum)	20 ns – 10 micro sec	
	Measuring pulse	10 – 50 V	
	Output impedance	8 – 500 Ohm	
	Sampling rate	400 MHz or higher	
	Input signal gain	-37 to +37 dB	
	De-attenuation	0 to + 22dB	
	SIM/MIM	Min. 15 TDR multi-shot measurements	
13.	Display range	20 m – 160km or higher	
	Resolution (minimum)	0.1 m	
	Accuracy	0.2% of measuring result	
	Propagation velocity factor	10 – 150 m/µs	
	Size of screen (Minimum)	10 inch	
	Power supply	100 – 240 V, 50 Hz	
	Power consumption(maximum)	280 VA	
14.	**IR test**		
	Test voltage	up to 20KV or higher	
	Measuring range	up to 650 M-Ohm(Inbuilt)	
15.	**Surge Voltage Generator**		
	Type	The Surge Generator Unit with built-in Cable Fault Analyzer should be used as thumper and DC Hipot for charging of cable under test (i.e. defective cable) till sufficient flashover is achieved at the point of fault. The set should be used in conjunction with Surge Receiver Unit for fault pinpointing.	
	Surge Voltage Ranges	0-4 KV, 0 – 8 kV, 0 – 16 kV, 0 – 32 kV	
	Surge Energy(minimum)	1100J @ 0-4kV voltage range 2000J @0 – 8, 0 – 16, 0 – 32 kV	

Sl. No.	Description	Required BPDB specifications	Manufacturer's Guaranteed Particulars
	DC Voltage	0 – 40 KV Continuously Variable or higher	
	Surge sequence	6 – 20 surges/min., single surge	
	standard safety features	• High voltage ON lamp • automatic grounding upon shutdown Auto-OFF in case of power supply break • overload protection with circuit breaker • automatic discharge • Reliable operated surge switch electromagnetic operated • Safety control circuit according to VDE 0104	
16.	Accessories to be provided	• mains leads • earth cable • HV connecting cable, auxiliary earth cable • carrying case • user's manual with complete operating and maintenance instructions.	
17.	**Filter unit for SIM/MIM/ARM**	Since pulse echo or reflection may not be suitable for high impedance or resistance faults. Thus, keeping in view, a suitable band pass inductive filter unit should be inbuilt into surge generator to stabilize the ARC at the flashover or the point of fault. The offered filter must simplify the operation causing less stress, causing minimum damage on the tested cables to detect the high resistive faults. There should be complete compatibility of TDR, Surge Generator/Thumper with inbuilt filter unit. This unit must filter or stabilize the arc at the fault point and record the same in the supplied TDR to compare it with previous trace recorded without the filter in the same core. Suitable connection for coupling the TDR and Surge generator with inbuilt filter must be available. The inbuilt filter must contain switching elements necessary for the triggering and the coupling of the pulse. After the pre-location using the ARM/SIM/MIM method, there must be an inbuilt decoupling element which must by pass the surge generator for making it ready for use in pinpointing the cable fault. The control unit should connect automatically the inbuilt filters with appropriate coupler with the surge generator and TDR when SIM/MIM mode.	
	Inductive coupler	Inductive Coupler required for pre-location of high resistance faults with a Surge Voltage Generator according to the Impulse Current Method (ICM).	
	Capacitive coupler	Capacitive voltage divider required for location of	

Sl. No.	Description	Required BPDB specifications	Manufacturer's Guaranteed Particulars
		intermittent cable faults up to 40 KVDC to perform the Decay Method.	
18.	**Surge Wave Receiver Unit**	The unit shall comprise of receivers, headphones, sensors, amplifiers and any other auxiliary item as necessary for operation of the unit.	
		Detection of both acoustic and electromagnetic pulses emitted from an arcing fault when it is surged.	
		Determine the proximity and direction to the cable fault	
		Measure the time delay between acoustic and electromagnetic signals.	
		Automatic Noise Suppression to filter and eliminate background noise.	
		Pinpoint the exact location of the fault.	
		Rechargeable battery/dry cell operated.	
		Mute feature to activate while in motion.	
		Adjustable/automatic feature for adjusting the electromagnetic gain & acoustic gain.	
		LCD display with backlit feature.	
		Acoustic headphone set shall be provided to receive the acoustic signal for pin pointing the fault point.	
		LCD display should indicate the cable route through the electromagnetic signal in bar graph form & the proximity to fault point by a numeric display of delay/distance.	
		Communication shall be done via a wireless or a wired connection.	
		Accessories to be provided: • lightweight receiver with carrying straps • handy sensor • carrying case • user's manual with complete operating and maintenance instructions	
19.	**Cable route tracer**	The set shall comprise of a transmitter & receiver.	
		The set shall battery operated (rechargeable) and portable type	
		The cable tracing shall be done with audio & visual signals	
		Detect the depth of the cable (at least 4 meter) at any point by using sufficient wattage of the generator up to 50watts at least.	
		Automatic impedance matching	
		Detect the AC signals (50 Hz) from a charged cable without transmitter.	
		Filters shall be provided to optimize the	

Sl. No.	Description	Required BPDB specifications	Manufacturer's Guaranteed Particulars
		measurements and minimize the ambient noise.	
		The transmitter of the tracer shall be capable of energizing the cable either by magnetic induction or by direct conductive connection to the cable.	
		The receiver shall filter out electric noise and static noise.	
		The unit shall also be able to determine the depth of the cable.	
		The unit shall be suitable to trace cables in areas with multiple energized / de-energized cables in the same route.	
20.	**Audio Frequency Generator**		
	LF output power (minimum)	0-200 Watt	
	O/P Frequencies	To be mentioned	
	Output Adjustment	To be mentioned	
	Permitted load resistance	any short circuit, open circuit, continuous but with reactive load etc.	
	Power Supply	shall be capable to work on mains AC supply with built in charging and battery unit.	
21.	**The audio frequency receiver**		
	type	battery operated, shall be connected directly to the search coil. The coil can be rotated to 0-45 degree or 90 deg spans in position	
22.	**Cable Identification Set**		
i.	**Transmitter**		
	Output voltage (minimum)	55V (15 pulses/min)	
	Output current(minimum)	100A	
	Power Supply	230v, 50 Hz Battery operated	
ii.	Receiver		
	Display	Graphic LCD/ Analog signal/LED Array	
	Sensitivity	100%; at 400 ohm	
	Power Supply	Battery operated	
23.	**Safety Measure**	• monitor auto discharge, earth monitoring, etc. from the central software • Visual indication of failure of safety circuits/incorrect selection etc. with possible corrective methods. • Constant monitoring of all safety circuits such as earth monitoring circuit etc. should be inbuilt into the control unit, safety interlock monitoring etc.	
24.	**Accessories to be provided**	• HV Cable with Cable drum rated up to 40 KV-25m	

Sl. No.	Description	Required BPDB specifications	Manufacturer's Guaranteed Particulars
		• Main Power supply lead-3m • Auxiliary Earthing cable drum-25m • Safety Earth/Ground cable -5 m	
25.	**Dimension**	To be mentioned	
26.	**Weight**	To be mentioned	

Seal and Signature of the Tenderer **Seal & Signature of the Manufacturer**

8.43 GUARANTEED TECHNICAL PARTICULARS FOR SFRA TEST SET

(To be filled up by the Seal & Signed by both manufacturer letter head pad ,than to be Sealed & Signed by both manufacturer & bidder otherwise the bid will be rejected)

Sl No.	Description	Purchaser's Requirement	Manufacturer's Guaranteed Particulars
01	Mfg's Name and Address	Shall be mentioned	
02	Mfg's Type / Model	Shall be mentioned	
03	Country of Origin	USA/Canada/Europe/Australia/Japan/S. Korea	
04.	Manufacturer's Authorization	To be mentioned	
05.	Original Catalogues	To be mentioned	
06	Application	Sweep Frequency Response Analysis for detecting electromechanical changes/failures in all types of power transformers.	
07	Power Supply	90-264VAC, 47-63 Hz, optional built-in battery	
	Analog source		
08	Channels	1	
09	Voltage output	24VPeak	
10	Output coupling	DC	
11	Output impedance	50 ohm	
12	Protection	Protected against overload and short circuit	
13	Frequency range	0.1 Hz – 25 MHz	
	Analog inputs		
14	Channels	2	
15	Sampling	Simultaneously	
16	Frequency range	0.1 Hz – 25 MHz	
17	Input impedance	50 Ohm	
18	Sample rate	100 MS/s	
19	Max input level	24 V (peak-to-peak), Measurement Voltage@50Ohm(12Vpeak).	
	Data collection		
20	Test method	Sweep frequency analysis	
21	Frequency range	0.1 Hz – 25 MHz	
22	No. of points	Up to 32 000 points, user selectable.	

Sl No.	Description	Purchaser's Requirement	Manufacturer's Guaranteed Particulars
23	Sweep settings	Individual settings for customer defined frequency bands. Linear and logarithmic scale or combination of both.	
24	Dynamic range	>130 dB	
25	Frequency resolution	> 0.01%	
26	Frequency accuracy	> 0.01%	
27	Level resolution	> 0.001 dB	
28	Accuracy	± 0.1 dB from +10 dB down to -40 dB ± 0.5 dB down to -100 dB	
29	IF bandwidth	User selectable, default <10%	
30	Calibration interval	Not exceeding three years	
	Data display		
31	Plotting	Magnitude (linear or log) Phase Difference Impedance Admittance Inductance Resistance Customer defined	
32	Scaling	Linear and logarithmic or combination	
33	**Data analysis**	Sub-band analysis Difference DL/T 911-2004 standard User-defined correlation analysis	
	Data management		
34	Software	Windows XP/ Windows7 for measurement control and data analysis	
35	Display	Operation through External PC / Laptop Built-in PC with powerful backlit screen for use in direct sunlight	
36	Database	Open XML format	
37	PC communication	USB (galvanic isolated)	
	Environmental		
38	Operating temperature	-20 to +55° C	
39	Operating relative humidity	< 95 % RH non-condensing.	
40	Storage temperature	-20 to +70° C	
41	EMC	EN 61000 and CISPR 11	
42	Communication	USB port	
	Standard accessories include:		

Sl No.	Description	Purchaser's Requirement	Manufacturer's Guaranteed Particulars
43	PC software	Windows based Testing & analysis Software	
	Cables and clamps	AC Power cord (IEC60320-C13 to US standard) AC Power cord (IEC60320-C13 to Schuko CEE 7/7) Canvas carrying bag (for leadset) Ground cable 5 m (16 ft) Earth/Ground braid lead 2 x 3 m (9 ft) Earth/Ground braid lead (insulated) 2 x 3 m (9 ft) C-clamp (Bushing clamps) 2 pcs C-clamp (Ground braid clamps) 2 pcs Field Test Box, FTB101 Earth/Ground braid with clamp 2 x 0.3 m (1 ft) Nylon accessory bag	
48	Documentation	User's manual (paper copy and in software)	
49		Calibration and Test Certificate	
50	Field test verification box	Kit Should be complied Cigre 342 report and fields test verification box shall be supplied along with instrument to assure Kit and cable healthiness in the field.	
	Optional accessories		
51	Custom length cable sets	Yes	
52	Battery	Built-in battery option	
53	Calibration set incl SW	Yes	
54	Dimension (HxWxD)	To be mentioned	
55	Weight	To be mentioned	
56	Printed catalogue shall furnish with identifying by indelible ink.	To be provided	

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Seal & Signature of theTenderer **Seal & Signature of the Manufacturer**

8.44 GUARANTEED TECHNICAL PARTICULARS FOR PORTABLE PARTIAL DISCHARGE MEASURING INSTRUMENT FOR GIS, TRANSFORMER AND CABLES

(To be filled up with the seal & Signed by both manufacturer and bidder in Manufacturer's Letterhead, otherwise the bid will be rejected)

Sl No.	Description	BPDB's Requirements	Manufacturer's Guaranteed Particulars
1.	Manufacturer 's name and address	To be mentioned.	
2.	Model	To be mentioned.	
3.	Country of Origin	USA/Canada/Europe/Australia/Japan/S. Korea	
4.	**General Requirement**	a) The instrument shall be supplied with the different types of pre-amplifiers for selecting the different bandwidth & increasing the sensitivity of measured partial discharge signal by IEC-60270, HFCT, Acoustic or UHF principle of detection.	
		b) The instrument shall be capable of connecting minimum 4 PD measurement channels, 1 gating channel and 1 external synchronization channel. The instrument needs to show partial discharge signals vs phase of the synchronized voltage.	
		c) The instrument shall have feature to show the Partial discharge signals in spectrum mode (Amplitude vs. Frequency) to identifiy the best signal to noise ratio.	
		d) To ensure a high versatility in various use-cases, the instrument should be operational through push-buttons and its built-in display and from a connected laptop.	
		e) The instrument shall provide a spectrum mode (Amplitude vs Frequency) to identify the best signal to noise ratio for measurements. The operator should be guided through an automatic spectrum calibration procedure. This function allows to calibrate the system at various measurement frequencies while the asset is offline. During online operation, the user can select the most suitable calibration and decide on the frequency providing the best signal-to noise ratio to ensure the best sensitivity.	

Sl No.	Description	BPDB's Requirements	Manufacturer's Guaranteed Particulars
		f) The instrument shall be capable to store on the device memory up to 20 calibration factors recorded at different measurement frequencies during calibration in spectrum mode. As a consequence the instrument should not need to become recalibrated again after energizing the asset and shifting the measurement frequency to best suited center frequency.	
		g) The instrument shall have feature to connect an external disturbance antenna. The disturbance antenna shall be used to pick up noise signals caused by local corona discharge. It shall be equipped with the magnetic holder, which allows a flexible placement on a transformer tank or to other metallic parts close to the object under test. The output signal can be used to trigger the gate input circuit of all PD acquisition.	
		h) The equipment must capable for measuring Partial Discharge in Noisy and charged sub-station environment.	
		i) The equipment shall be battery operated with built-in battery charger and capable of testing for minimum 3 hours. It shall also be suitable for 230V AC/50 Hz input.	
		j) The equipment shall be capable of showing stable reading in presence of vibrations within complex assemblies of electrical asset, which can produce high frequency disturbance signals in the frequency spectra of Partial Discharge.	
		k) The Instrument shall be operated through software installed over PC/Laptop for analysis or without software.	
		l) The expert software shall be part of the instrument offer, which can accurately interpret the root cause of partial discharges like corona, protrusions, gas inclusions (voids), surface discharges, and others etc.	
		m) The instrument needs to show partial discharge signals vs. phase of the synchronized voltage.	

Sl No.	Description	BPDB's Requirements	Manufacturer's Guaranteed Particulars
		n) The instrument shall include a built-in server that allows continuous data recording, analysis and storage. The built-in server should be accessible through a web interface (TCP/IP connection). It should allow the manual operation of the instrument. Furthermore, it should allow the instrument to operate as a standalone system without operator presence for days, weeks or month. During such an operation, the system should automatically record a trending of the PD activity. In case configurable thresholds are exceeded, the instrument should store the current measurement as a PRPD with a date and time stamp, the sensor/channel on which it occurred and allow the operator to review the PD activity in an alarm event list when accessing through the web interface.	
		o) The instrument shall be housed in a IP65 enclosure for prolonged outdoor operation. The cable connections should be available from the outside of the enclosure to ensure the protection class while the instrument is fully set up and in operation. The housing should be temperature and humidity controlled.	
		1) Supply should cover a) 4 Channel PD Measurement Instrument X 1 qty b) Set of UHF Connection accessories for GIS X 3 qty c) Set of Quadrupole and Pre-amplifier X 3qty d) UHF Drain Valve Sensor X 1 qty e) HFCT X 3 qty f) Disturbance Antenna X 1 qty g) Transport Case X 1 qty h) Suitable case and hardware for Temporary Continuous monitoring purpose	
5.	**Technical Data for PD monitoring system**		
6.	**<u>Acquisition unit</u>**:	Mains supply: 90–264 VAC, 47–440 Hz Power requirements: Approx. 60 VA Battery lifetime: Up to 3 hours Display: Backlit LCD Display resolution : 128 x 240 Pixel B/W	

Sl No.	Description	BPDB's Requirements	Manufacturer's Guaranteed Particulars
		Operation: 5 menu supported pushbutton : 5 fix function pushbuttons or remote controlled via software Remote connection: USB , LAN , Modem, UMTS Input impedance : 50 W// 50 pF (AMP IN) A/D converter (PD): 8 bit (unipolar) / ±7 bit (bipolar) Opt. recorder output: 0–10 V with R=100Ohm	
7.	**Standard PD Mode:**	Lower cut-off (-6 dB): 40, 80, or 100 kHz (software controlled) Upper cut-off (-6 dB): 250, 600, or 800 kHz (software controlled) Input sensitivity: < 500 µVrms / 5pC (without preamplifier) Gain range: 1, 2, 4, 8, 10, 20 …, 200,400, 800	
8.	**Preamplifier**	Input impedance: 1 kΩ // 50 pF Input sensitivity: < 15 µVrms /0.02 pC Bandwidth: 40 kHz–20 MHz	
9.	**Synchronization**	Sync. Frequency : 8–320 Hz Maximum voltage : 200 Vpeak (140 Vrms),100 Vrms nom. Input impedance : 10 MW	
10.	**Spectrum Function**	Input sensitivity: < 5 µVrms / 0.5 pC (270 kHz bandwidth) : < 1 µVrms / 2 pC (9 kHz bandwidth) Max. input voltage : 120 mVrms (270 kHz bandwidth): 5 mVrms (9 kHz bandwidth) : 2.5 mVrms (RIV) Frequency range : 10 kHz–10 MHz (in steps of 10 kHz) Bandwidth: 9 kHz or 270 kHz Precision: Typ. < 5%	
11.	**Quadrupole**	Coupling capacitance range: 600 pF to 2.5 nF Max. current: 400 mA Input connection: Banana Output connection: BNC (RG 58 / 50 ohm)	
12.	**HFCT**	Transfer ratio at 50 ohms: 1:10 Primary window: 100 mm Bandwidth at -3dB: 2-25 MHz Bandwidth at -6dB: 1.2 -40 MHz	
13.	**UHF Drain Valve Sensor**	Frequency range: 300 MHz–1000 MHz Flange connections: DN-40 or DN-50 or DN-100 Frequency Converter: built-in UHF to HF converter	

Sl No.	Description	BPDB's Requirements	Manufacturer's Guaranteed Particulars
14.	**Disturbance Antenna**	Frequency range: 20 MHz - 150 MHz Connector: 1 x TNC	

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Bidder's signature with seal Manufacturer's signature with seal

8.45 Guaranteed Technical Particulars of Bay Control & Protection Unit (BCPU)

(To be filled up by the Manufacturer, otherwise the bid shall not be considered for evaluation)

SL. No.	Description	Unit	BPDB's requirements	Manufacturer's guaranteed Particulars
1	Manufacturer		To be mentioned	
2	Country of Origin (Place of Manufacturing)		To be mentioned	
3	Relay Identification			
3.1	Relay Type & model		To be mentioned	
3.2	Relay Software version		To be mentioned	
3.3	Relay Hardware version		To be mentioned	
4	Language		English	
5	Housing & mounting		Flush mounting housing and capable of sustaining in harsh environmental condition	
6	Relay auxiliary voltage	V	Minimum range of 88V to 250V DC and minimum range of 115V to 230V AC	
7	Operating frequency	Hz	50Hz, ±5%	
8	Current transformer requirement			
8.1	No of Inputs	Nos.	4	
8.2	Nominal current	A	Operable in 1A and 5A	
8.3	Minimum continuous current capacity	A	3*Nominal current	
8.4	Thermal withstand capacity	A	100*Nominal current for at least 1s	
9	Voltage transformer requirement			
9.1	No of Inputs	Nos.	10	
9.2	Nominal voltage	V	110	
9.3	Minimum continuous withstand voltage	V	220	
10	Binary input module			
10.1	Minimum number of inputs	Nos.	10 (programmable)	
10.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11	Binary output module			
11.1	Minimum number of outputs	Nos.	10 (minimum 5 Nos. fast operating trip output and 1 Nos. watchdog outputs)	
11.2	Minimum operating range	V	110V and 220V DC (±20% tolerance)	
11.3	Minimum continuous current capacity	A	5	
11.4	Short time withstand capacity	A	10A for at least 1s	
11.5	Maximum operating time	ms	10	

SL. No.	Description	Unit	BPDB's requirements	Manufacturer's guaranteed Particulars
12	Number of LEDs	Nos.	08 (programmable)	
13	HMI		Front mounted, should be suitable to issue close& open commands to switching devices through visual animation, access all functions, settings and stored records without external computer	
14	Software requirement		1. Should be able to configure, operate and monitor with user friendly engineering and disturbance handling tool. 2. Necessary software for configuration, disturbance handling and parameterization has to be supplied free of cost and without any time- bounded license.	
15	GPS Time synchronization		Shall be available	
16	Communication interface			
16.1	Standard protocol		IEC 61850 (have to be able to communicate to IEC 61850 base Substation Automation System)	
16.2	Ethernet speed and connector		100Mbps, RJ45 plug connector/RS232 serial connector as front port	
17	Main protection function		Instantaneous/delayed, directional/non- directional, over current and earth fault protection with IEC and ANSI/IEEE characteristics curves	
17.1	Number of parameter setting groups	Nos.	Minimum 4 (Independently settable)	
17.2	Minimum stages in each setting groups for Over-current	Nos.	3	
17.3	Minimum stages in each setting groups for Earth fault	Nos.	3	
17.4	Pre-configuration		For all basic functions	
17.5	Tripping time		Settable between 0s to 150s	
17.6	Pick up setting range for Time delayed Directional/Non-directional OC	A	0.1*In to at least 20*In (step size 0.01)	
17.7	Pick up setting range for High set Directional/Non-directional OC	A	0.5*In to at least 35*In (step size 0.1)	
17.8	Pick up setting range for Time	A	0.01*In to at least 20*In (step	

SL. No.	Description	Unit	BPDB's requirements	Manufacturer's guaranteed Particulars
	delayed Directional/Non-directional EF		size 0.01)	
17.9	Pick up setting range for High set Directional/Non-directional EF	A	0.5*In to at least 35*In (step size 0.1)	
17.10	TMS setting range for IDMT		0.025 to at least 1.5 (step size 0.025)	
18	Other protection functions		Comprehensive voltage protection functionality including over-voltage, under-voltage, negative sequence overvoltage and residual over-voltage protection	
19	Control functions		i. Synchrocheck ii. Implementing interlocking logics iii. Execution of close and open command for switching devices coming from SAS and Device HMI	
20	Monitoring functions			
20.1	U, I, P, Q, S, f, PF monitoring	Yes/ No	Yes	
20.2	Event records and oscillographic disturbance records		Event recorder should keep at least 10Nos previous records and disturbance recorder should handle at least 8Nos analogue channels and at least 16Nos binary channels	
21	Tripping and indication logics		Shall be programmable	
22	Standards		Shall conform IEC-60255 in all aspects	
23	Type test certificate		Shall be provided	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

8.46 TECHNICAL REQUIREMENT & GUARANTEE SCHEDULE FOR DAS & DTS SYSTEM

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate data, otherwise bid shall be rejected.)

Sl. No	DESCRIPTION	BPDB REQUIREMENT	Bidders declared Value
1.	Name of the Manufacturer/Developer	Shall be mentioned	
	Country of Origin	Shall be mentioned	
	Model/Type	Shall be mentioned	
2.	**General Requirement:**		
	Standards to be complied with DAS & DTS system		
	Communication protocol at all levels	IEC61850. Fully complying with the standard.	
	Temperature range (min/max) Computer	Shall be mentioned	
	Sensing Range/Distance (km)	Shall be mentioned	
3.	**Detailed Requirements for Cable Monitoring System:**		
3 (a)	**Distributed Temperature Sensing (DTS)**		
	Name of the Manufacturer	Shall be mentioned	
	Model/Type	Shall be mentioned	
3 (b)	**Distributed Acoustic Sensing (DAS)**		
	Name of the Manufacturer	Shall be mentioned	
	Model/Type	Shall be mentioned	
4.	**Remote Terminal Unit**		
	Manufacturer's name & address - Standard - Supported Protocol - Power Supply - Communication Ports - Operation Temperature - RTU shall be expandable - Panel	Shall be mentioned IEC/IEEE IEC-61850 Edition 2 IEC 60870-5-104 Modbus To be provided To be provided To be provided Yes Simplex	
	Dimensions of ubicle - Width - Depth - Height	 mm mm mm	

Seal & Signature of the Manufacturer **Seal & Signature of the Bidder**

Section 9. Drawings

Annexure-1: Single Line Diagram

01	33/11kV, 2X5/6.67MVA, regular type **AIS** Substation at **Amratoli**, under ESU, Burichang, BPDB, Cumilla.
02	33/11kV, 2X5/6.67MVA, regular type **AIS** Substation at **Gachtola Bridge**, under SND, Chandpur, BPDB, Candpur.
03	33/11kV, 2X10/13.33MVA, regular type **AIS** Substation at **Dhonaitori**, under SND-3, Cumilla, BPDB, Cumilla.
04	33/11kV, 2X10/13.33MVA, regular type **AIS** Substation at **Lakhshminarayanpur** under SND, Chowmuhani, BPDB, Chowmuhani.
05	33/11kV, 2X10/13.33MVA, regular type **AIS** Substation at **Mohabbatpur** under Dist. Div. Noakhali, BPDB, Noakhali.
06	33/11kV, 2X16/20MVA, regular type **AIS** Substation at **Alekhar Char** under SND-1, Cumilla, BPDB, Cumilla.
07	33/11kV, 2X10/10.33MVA, regular type **GIS** Substation at **Dhanpur** under SND-2, Cumilla, BPDB, Cumilla.
08	33/11kV, 2X16/20MVA, regular type **GIS** Substation at **Housing Estate** under SND-2, Cumilla, BPDB, Cumilla.