Bangladesh Economic Zones Authority (BEZA)
Bangladesh Economic Zones Development Project (Phase- I)

BDBL Bhaban, Level-15
12 Kawran Bazaar, Dhaka.
Web Site: www.beza.gov.bd

TENDER DOCUMENT (NATIONAL)
FOR THE PROCUREMENT OF WORKS
National Competitve Bidding (NCB)

Name of works:	Construction of 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station (MRSS) for Mongla EZ

Invitation for Tender no: 5
Tender Package No: BEZAWD-16

Issued on:……
……..
……

Date of issue :……

Table of Contents

Invitation for Tenders

Bangladesh Economic Zones Authority (BEZA)

Bangladesh Economic Zones Development Project (Phase- I)

BDBL Bhaban, Level-15
12 Kawran Bazaar, Dhaka.
www.beza.gov.bd

Invitation for Tenders		
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH		
1	Ministry/Division:	**Prime Minister's office**
2	Agency:	**Bangladesh Economic Zones Authority (BEZA)**
3	Procuring Entity Name:	Bangladesh Economic Zones Authority (BEZA) represented by Project Director, Bangladesh Economic Zones Development Project (Phase- I)
4	Procuring Entity District:	Dhaka
6	Invitation For:	Works
7	Invitation Ref No.:	03.762.014.00.05.014.2014-81
8	Date:	19/01/2015
KEY INFORMATION		
9	Procurement Method:	National Competitive Bidding (NCB)
FUNDING INFORMATION		
10	Budget and Source of Funds:	International Development Association(IDA) & Department for International Development (DFID)
PARTICULAR INFORMATION		
11	Project name:	Bangladesh Economic Zones Development Project (Phase- I)
12	Tender package name:	Construction of 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station (MRSS) Mongla EZ at Bagerhat district, Khulna division.
13	Tender publication date:	On or before 26th January 2015
14	Tender last selling date:	25th February 2015 , during office hours
15	Tender closing date and time:	26th February 2015 at 14:00 hours local time
16	Tender opening date and time:	26th February 2015 at 14:30 hours local time
17	Name & addresses of the offices :	**Selling & Receiving Tender Document:** Project Director, Bangladesh Economic Zones Development Project (Phase- I), Bangladesh Economic Zones Authority (BEZA), BDBL Bhaban, Level-15, 12 Kawran Bazaar, Dhaka. **Opening Tender Document:** Conference Room, BDBL Bhaban,Level 15, 12 Kawran Bazaar, Dhaka.

INFORMATION FOR TENDERER		
18	Eligibility of Tenderer:	This invitation for Tender is open to all eligible Tenderers as mentioned in tender document and should meet the following pre-conditions. 1) The minimum number of years of general experience of the Tenderer in the construction works shall be 3 (three) years with having adequate experience of Construction of 33 kv transmission lines and 33kv/11kv MRSS 2) The minimum specific experience in construction works of at least 2 (Two) contracts of similar nature, complexity and methods/construction technology successfully completed within the last 5 (Five) years, each with a value of at least BDT 600 (Six hundred) Lakh. 3) The tenderer shall have a minimum average annual construction turnover of any best of 5 (five) years during the last 10 (ten) years amounting to BDT 1200 (One thousand and two hundred) Lakh. 4) The minimum amount of liquid assets or working capital or credit facilities in the form of bank confirmed credit certificate already available to the Tenderer shall be BDT 200 (Two hundred) Lakh . 5) Other required eligibility criteria & conditions have been mentioned in tender document
19	Brief description of works:	Work consist of Construction of 33 kV Over Head Transmission line, 33 / 11 kV Main Receiving sub Station with, 33/11 kV step down power transformer, station transformer, Vacuum circuit breaker, isolators, Current transformer, voltage transformer, lightning arrester, post insulator, pin insulator, control and relay panel, structural steel work, earth mat, earth pit, light mast, AAAC conductor, end clams, aluminium bus bar, area lighting, construction control room, Earth works, construction of civil foundation work, soak pit, illumination work, etc.
20	Special Condition	If there happens any transport disruption or Govt. holidays on the above mentioned dates, the next normal working day will be treated as the valid dates of selling, dropping and opening of the tender. Time shall remain unchanged.
21	Price of Tender Document:	BDT. 5000 (Five Thousand) in cash (Non-Refundable)

22

Lot No.	Identification	Location	Security Amount (Tk.)	Completion Time
BEZAWD-16	Construction of 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station (MRSS)	Mongla, Bagerhat district.	20,00,000	9 Months

PROCURING ENTITY DETAILS		
23	Name of Official Inviting Tender:	ABM Abdul Fattah
24	Designation of Official Inviting Tender:	Project Director, Bangladesh Economic Zones Development Project (Phase- I)
25	Address of Official Inviting Tender	BDBL Bhaban, Level 15, 12 Kawran Bazaar, Dhaka
26	Contact Details of Official Inviting Tender	Phone: 8180125

27	The procuring entity reserves the right to accept or reject any/all tender(s) without assigning any reason whatsoever.

(ABM Abdul Fattah)
Project Director (Joint Secretary)
Phone - 8180125

Instructions to Tenderers

Section 1. Instructions to Tenderers

A. General

1. Scope of Tender

1.1 The Procuring Entity, as indicated in the Tender Data Sheet (TDS) issues this Tender Document for the procurement of Works and associated Services incidental thereto as specified in the **TDS** and as detailed in **Section 6: Bill of Quantities**. The name of the Tender and the number and identification of its constituent lot(s) are stated in the **TDS**.

1.2 The successful Tenderer shall be required to execute the works and physical services as specified in the 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;
(c) "day" means calendar days unless otherwise specified as working days;
(d) "Person" means and includes an individual, body of individuals, sole proprietorship, partnership, company, association or cooperative society that wishes to participate in Procurement proceedings;
(e) "Tenderer" means a Person who submits a Tender;
(f) "Tender Document" means the Document provided by a Procuring Entity to a Tenderer as a basis for preparation of the Tender; and
(g) "Tender" depending on the context, means a Tender submitted by a Tenderer for execution of Works and Physical Services to a Procuring Entity in response to an Invitation for Tender.

3. Source of funds

3.1 The Procuring Entity has been allocated public funds 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 monetary resources appropriated to Procuring Entities under Government budget, or loan, grants and credits placed at the disposal of Procuring Entities through the Government by the Bank or foreign states or organisations.

3.3 Payments by the Bank, if so indicated in the **TDS**, will be made only at the request of the Government and upon approval by the Bank 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 practices

4.1 The Government and the Bank require that Procuring Entities, as well as Tenderers and Contractors (including their suppliers, 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 a 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 a 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 a Procuring Entity 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 a Contract, and this will include creating obstructions in the normal submission process used for Tenders.

(e) "obstructive practice" 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 practice of any kind is determined by the Procuring Entity or the Bank, this will be dealt with in accordance with the provisions of the Procurement Guidelines of the Bank as stated in the **TDS** in combination with ITT sub-clause 4.4 and the Procurement Laws.

4.4 If corrupt, fraudulent, collusive, coercive or obstructive practices of any kind is determined against any Tenderer or Contractor (including its suppliers, sub-contractors, agents, personnel, consultants, and service providers) in competing for, or in executing a contract under public fund, the Bank shall :

(a) exclude the concerned Tenderer from further participation in the concerned procurement proceedings;

(b) reject any recommendation for award that had been proposed for that concerned Tenderer;

(c) 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, or coercive practices during the procurement or the execution of that contract, without the Procuring Entity having taken timely and appropriate action satisfactory to the Bank to remedy the situation; and

(d) sanction the concerned Tenderer or individual, at any time, in accordance with prevailing Bank's 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 Bank-financed contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract.

4.5 The Tenderer shall be aware of the provisions on corruption, fraudulence, collusion, coercion and obstruction as stated in GCC Clause 39 and 89.1(b) (vii).

4.6 In further pursuance of this policy, Tenderers, suppliers and contractors, and their sub-contractors, agents, personnel, consultants, service providers shall permit the Government and the Bank 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 Bank.

5. Eligible Tenderers

5.1 A Tenderer, and all partners constituting the Terderer, may have the nationalities of any country except the nationalities

specified in the TDS.

5.2 A Tenderer 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, Consortium or Association (JVCA) invited to take part in public procurement or seeking to be so invited or submitting a Tender in response to an Invitation for Tenders.

5.3 A 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.

5.4 The Tenderer shall have the legal capacity to enter into the Contract.

5.5 A Tenderer shall not have a conflict of interest. All Tenderers found to have a conflict of interest shall be disqualified. A Tenderer may be considered to have a conflict of interest with one or more parties in this tendering process, if :

(a) they have a controlling partner in common; or
(b) they receive or have received any direct or indirect subsidy from any of them; or
(c) they have the same legal representative for purposes of this Tender; or
(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Tender of another Tenderer, or influence the decisions of the Procuring Entity regarding this tendering process; or
(e) a Tenderer or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Tender; or
(f) A Tenderer, or any of its affiliates has been hired (or is proposed to be hired) by the Procuring Entity as Engineer for the contract.

5.6 The Tenderer 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, coercive, or obstructive practices as stated under ITT Clause 4.

5.7 The Tenderer with a poor performance, such as abandoning the works, not completing contracts, or financial failure, or with a consistent history of litigation or arbitration awards against it shall not be eligible to Tender.

5.8 The Tenderer 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.

5.9 The Tenderer 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.

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

5.11 These requirements for eligibility will extend, as applicable, to each JVCA partner and Subcontractor proposed by the Tenderer.

5.12 A Tenderer is under declaration of ineligibility by the Bank and / or the Procuring Entity in accordance with the above ITT clause 4, or in relation to the Bank's *Guidelines on Preventing and Combating Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants*, shall not be eligible to be awarded a contract.

6. Eligible materials, equipment and associated services

6.1 All materials, equipment and associated services to be supplied under the Contract are from eligible sources, unless their origin is from a country specified in the TDS.

6.2 For the purposes of this Clause, "origin" means the place where the Materials and Equipment are mined, grown, cultivated, produced or manufactured or processed, or through manufacturing, processing, or assembly, another commercially recognized new product results that differs substantially in its basic characteristics from its components or the place from which the associated services are supplied.

6.3 The origin of materials and equipment and associated services is distinct from the nationality of the Tenderer.

7. Site visit

7.1 The Tenderer is advised to visit and examine the Site of Works 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 construction of the Works.

7.2 The Tenderer and any of its personnel or agents will be granted permission by the Procuring Entity to enter into 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 Procuring Entity 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 Procuring Entity 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 Bill of Quantities (BOQ)
- Section 7 General Specifications
- Section 8 Particular Specifications
- Section 9 Drawings

8.2 The Procuring Entity is not responsible for the completeness of the Tender Document and their addenda, if these were not purchased directly from the Procuring Entity, or through its agent(s) 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 in addendum to tender, if any.

9. Clarification of tender document

9.1 A prospective tenderer requiring any clarification of the Tender Document shall contact the Procuring Entity in writing at the Procuring Entity's address and within time as indicated in the **TDS.**

9.2 A 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 and ITT Sub Clause 42.2.

10. Pre-tender meeting

10.1 To clarify issues and to answer questions on any matter arising in the Tender Document, the Procuring Entity 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 and invited to attend the meeting, if it is held.

10.2 The Tenderer is requested to submit any questions in writing so as to reach the Procuring Entity no later than one day prior to the date of the meeting.

10.3 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 five (5) working days after holding the meeting to all those who purchased the Tender document and to even those who did not attend the meeting. Any revision to the Tender document listed in ITT Sub-Clause 8.1 that may become necessary as a result of the pre-Tender meeting will be made by the Procuring Entity exclusively through the issue of an Addendum pursuant to 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 Procuring Entity, on its own initiative or in response to an inquiry 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.

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 must be circulated by fax, mail or e-mail, to Tenderers who have purchased the Tender Documents, within five (5) working days.

11.3 The Tenderers will acknowledge receipt of an Addendum within three (3) working days.

11.4 Procuring Entities shall also ensure posting of the relevant addenda with the reference number and date on their websites including notice boards, where the Procuring Entities had originally posted the IFTs.

11.5 To give a prospective Tenderer reasonable time in which to take an addendum into account in preparing its Tender, the Procuring Entity may, at its discretion, extend the deadline for the submission of Tenders, pursuant to ITT Sub Clause 42.2.

11.6 If an addendum is issued when time remaining is less than **one-third** of the time allowed for the preparation of Tenders, a Procuring Entity at its discretion 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. In any case, the minimum time for such extension shall not be less than three (3) working 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 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 Litigation history shall comply with the requirement as specified in ITT 15.1(c).

14. Experience criteria

14.1 The Tenderer shall have the following minimum level of construction experience to qualify for the performance of the Works under the Contract:

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

(b) Specific experience as a Prime Contractor or Subcontractor or Management Contractor in construction works of a nature, complexity and methods/construction technology similar to the proposed Works 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 The Tenderer shall have the following minimum level of financial capacity to qualify for the performance of the Works under the Contract.

(a) the average annual **construction** turnover as specified in the **TDS** 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 Works under the Contract:

(a) a Construction 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 (JVCA)

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) 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 PW3-3)** for submission with the Tender.

19. Subcontractor(s)

19.1 A Tenderer may intend to subcontract an activity or part of the Works, in which case such elements and the proposed

Subcontractor shall be clearly identified.

19.2 The Procuring Entity 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.

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

19.4 The successful Tenderer shall under no circumstances assign the Works or any part of it to a Subcontractor.

19.5 Each Subcontractor shall complete the Subcontractor Information (**Form PW3-4**) for submission with the Tender.

D. Tender Preparation

20. Only one Tender

20.1 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 in one (1) lot will cause all the Tenders of that particular Tenderer to be rejected.

21. Cost of Tendering

21.1 The Tenderer shall bear all costs associated with the preparation and submission of its Tender, and the Procuring Entity 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 Procuring Entity 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.

22.2 There shall not be any pre-conditions whatsoever, for sale of Tender Documents 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 The Tender 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 Tenderer 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 The Tenderer shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.

24. Contents of Tender

24.1 The Tender prepared by the Tenderer will comprise the following:

(a) the Tender Submission Letter in accordance with ITT Clause 25 (**Form PW3-1**);
(b) Tenderer Information in accordance with ITT Clauses 5, 29 and 32 (**Form PW3-2**);
(c) the priced Bill of Quantities for each lot in accordance with ITT Clauses 25,27 and 28;
(d) Tender Security as stated under ITT Clauses 35, 36 and 37.
(e) alternatives, if permissible, as stated under ITT Clause 26;
(f) written confirmation authorizing the signatory of the Tender to commit the Tenderer, as stated under ITT Sub Clause 40.3;
(g) Valid Trade license ;
(h) documentary evidence of Tax Identification Number (TIN) and Value Added Tax (VAT) as a proof of taxation obligations as stated under ITT Sub Clause 5.9;
(i) documentary evidence as stated under ITT Clause 29 establishing the Tenderer's qualifications to perform the Contract if its tender is accepted;
(j) Technical Proposal describing work plan & method, personnel, equipment and schedules as stated under ITT Clause 31;
(k) documentary evidence as stated under ITT Clause 32 establishing the minimum qualifications of the Tenderer required to be met for due performance of the Works and physical services under the Contract; and
(l) Any other document as specified in the **TDS**.

24.2 In addition to the requirements stated under ITT Sub Clause 24.1, Tenders submitted by a JVCA or proposing a Subcontractor shall include:

(a) 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
(b) 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;
(c) the JVCA Partner Information (**Form PW3-3**);
(d) The Subcontractor Information (**Form PW3-4**).

25. Tender Submission Letter and Bill of

25.1 The Tenderer shall submit the Tender Submission Letter (**Form PW3-1**), which shall be completed without any

Quantities		alterations to its format, filling in all blank spaces with the information requested, failing which the Tender may be rejected as being incomplete.
	25.2	The Tenderer shall submit the priced Bill of Quantities using the form(s) furnished in **Section 6: Bill of Quantities.**
	25.3	If in preparing its Tender, the Tenderer has made errors in the unit rate or price or the total price, and wishes to correct such errors prior to submission of its Tender, it may do so, but shall ensure that each correction is initialled by the authorised person of the Tenderer.
26. Alternatives	26.1	Unless otherwise stated in the **TDS**, alternatives shall not be considered.
	26.2	When alternative times for completion are explicitly invited, a statement to that effect will be included in the **TDS**, as will the method of evaluating different times for completion.
	26.3	Except as provided under ITT Sub Clause 26.4, Tenderers wishing to offer technical alternatives to the requirements of the Tender Documents **must first price** the Procuring Entity's design as described in the Tender Documents and shall further provide all information necessary for a complete evaluation of the alternative by the Procuring Entity, including drawings, designs, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details.
	26.4	When specified in the **TDS**, Tenderers are permitted to submit alternative technical solutions for specified parts of the Works, and such parts will be identified in the **TDS**.
	26.5	Only the technical alternatives, if any, of the lowest evaluated tenderer conforming to the basic technical requirements will be considered by the Procuring Entity.
27. Tender prices, discounts and price adjustment	27.1	The prices and discounts quoted by the Tenderer in the Tender Submission Letter (**Form PW3-1**) and in the Bill of Quantities (BOQ) shall conform to the requirements specified below.
	27.2	The Tenderer shall fill in unit rates or prices for all items of the Works both in figures and in words as described in the BOQ.
	27.3	The items quantified in the BOQ for which no unit rates or prices have been quoted by the Tenderer will not be paid for, by the Procuring Entity when executed and shall be deemed covered by the amounts of other rates or prices in the BOQ and, it shall not be a reason to change the Tender price.

27.4 The Procuring Entity may, if necessary, require the Tenderer to submit the detail breakdown of the unit rates or prices quoted by the Tenderer for the facilitation of the Tender proceedings.

27.5 The price to be quoted in the Tender Submission Letter, as stated under ITT Sub Clause 25.1, shall be the total price of the Tender, excluding any discounts offered**.**

27.6 The Tenderer shall quote any unconditional discounts and the methodology for application of discount in the Tender Submission Letter as stated under ITT Sub Clause 25.1.

27.7 Tenderers wishing to offer any price reduction for the award of more than one lot shall specify in their Tender the price reductions applicable to each lot, or alternatively, to any combination of lots within the package. Price reductions or discounts will be submitted as stated under ITT Sub Clause 27.1, provided the Tenders for all lots are submitted and opened together.

27.8 All applicable taxes, custom duties, VAT and other levies payable by the Contractor under the Contract, or for any other causes, as of the date twenty-eight (28) days prior to the deadline for submission of Tenders, shall be included in the unit rates and prices and the total Tender price submitted by the Tenderer.

27.9 Unless otherwise provided in the **TDS** and the Contract, the price of a Contract shall be fixed in which case the unit rates or prices may not be modified in response to changes in economic or commercial conditions.

27.10 If so indicated under ITT Sub Clause 27.9, 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 GCC Clause 71 and, in such case the Procuring Entity shall provide the indexes and weightings or coefficients in **Appendix to the Tender** for the price adjustment formulae specified in the PCC.

27.11 The Procuring Entity may require the Tenderer to justify its proposed indexes, if any of those as stated under ITT Sub Clause 27.10, are instructed to be quoted by the Tenderer in **Appendix to the Tender**.

28. Tender Currency

28.1 The Tenderer shall quote all prices in the Tender Submission Letter and in the Bill of Quantities in Bangladesh Taka currency unless otherwise specified in the **TDS**.

29. Documents

29.1 A Tenderer, if applying as a sole Tenderer, shall submit

Establishing Eligibility of the Tenderer

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 PW3-1**);
(b) complete the Tenderer Information (**Form PW3-2**);
(c) Provide completed Subcontractor Information (**Form PW3-4**), if it intends to engage any Subcontractor(s).

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

(a) provide for each JVCA partner, completed JVCA Partner Information (**Form PW3-3**);
(b) Provide the JVCA agreement or Letter of Intent along with the proposed agreement of the intended JVCA as stated in ITT Sub Clause 18.1.

30. Documents Establishing the Eligibility and Conformity of Materials, Equipment and Services

30.1 The Tenderer shall submit documentary evidence to establish the origin of all Materials, Equipment and services to be supplied under the Contract as stated under ITT Clause 6.

30.2 To establish the conformity of the Materials, Equipment and services to be supplied under the Contract, the Tenderer shall furnish, as part of its Tender, the documentary evidence (which may be in the form of literature, specifications and brochures, drawings or data) that these conform to the technical specifications and standards specified in **Section 7, General Specifications** and **Section 8, Particular Specifications.**

31. Documents Establishing Technical Proposal

31.1 The Tenderer shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in **TDS**, in sufficient detail to demonstrate the adequacy of the Tenderer's proposal to meet the work requirements and the completion time.

32. Documents Establishing the Tenderer's Qualification

32.1 Tenderers shall complete and submit the Tenderer Information (**Form PW3-2**) and shall include documentary evidence, as applicable to satisfy the following:

(a) general experience of construction works as stated under ITT Sub Clause 14.1(a) ;
(b) specific experience in construction works of similar nature and size as stated under ITT Sub Clauses 14.1(b)
(c) average annual **construction** turnover for a period as stated under ITT Sub Clause 15.1(a);
(d) adequacy of working capital for this Contract i.e. access to line(s) of credit and availability of other financial resources as stated under ITT Sub Clause 15.1(b);
(e) technical and administrative personnel along with their qualification and experience proposed for the Contract as stated under ITT Clause 16;
(f) major items of construction equipment proposed to carry out the Contract as stated under ITT Clause 17;
(g) Authority to seek references from the Tenderer's bankers or any other sources.
(h) information regarding any litigation, current or during the last five years, in which the Tenderer is involved, the parties concerned, and disputed amount;
(i) Reports on the financial standing of the Tenderer, such as profit and loss statements and auditor's reports for the past five years.

32.2 A Procuring Entity shall disqualify a Tenderer who submits a document containing false information for purposes of qualification or mislead or makes false representations in proof of qualification requirements. A Procuring Entity may declare such a Tenderer ineligible, either indefinitely or for a stated period of time, from participation in future procurement proceedings

32.3 A Procuring Entity may disqualify a Tenderer if it finds at any time that the information submitted concerning the qualifications of the Tenderer was materially inaccurate or materially incomplete. Also, a Procuring Entity may disqualify a Tenderer who has record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays, litigation history or financial failures.

33. Validity Period of Tender

33.1 Tenders shall remain valid for the period specified in the **TDS** after the date of Tender submission deadline prescribed by the Procuring Entity. A Tender valid for a period shorter than that specified will be rejected by the Procuring Entity as non-responsive.

34. Extension of Tender

34.1 In exceptional circumstances, prior to the expiration of the

Validity and Tender Security

Tender validity period, the Procuring Entity may solicit the Tenderers' consent to an extension of the period of validity of their Tenders.

34.2 The request and the responses shall be made in writing. Validity of the tender security provided under ITT Clause 35 shall also be suitably extended for twenty eight (28) days beyond the new date for the expiry of the Tender Validity. If a Tenderer does not respond or refuses the request it shall not forfeit its tender security, but its tender shall no longer be considered in the evaluation proceedings. A Tenderer agreeing to the request will not be required or permitted to modify its tender.

35. Tender Security

35.1 The Tenderer shall furnish as part of its Tender, in favour of the Procuring Entity or as otherwise directed on account of the Tenderer, a Tender Security in original form and in the amount, as specified in the **TDS**.

35.2 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 35.2.

36. Form of tender security

36.1 The Tender Security shall:

(a) at the Tenderer's option, be either;

i. in the form of a bank draft or pay order, or
ii. in the form of an irrevocable bank guarantee issued by a scheduled Bank of Bangladesh, in the format (**Form PW3-6**) furnished in **Section 5: Tender and Contract Forms**;

(b) be payable promptly upon written demand by the Procuring Entity in the case of the conditions listed in ITT Sub Clause 39 being invoked; and

(c) 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 as stated under ITT Sub Clause 39.1.

37. Authenticity of Tender Security

37.1 The authenticity of the Tender Security submitted by a Tenderer may be examined and verified by the Procuring Entity at its discretion in writing from the Bank issuing the security.

37.2 If a Tender Security is found to be not authentic, the Procuring Entity may proceed to take measures against that

Tenderer as stated under ITT Sub Clause 4.4.

37.3 A Tender not accompanied by a valid Tender Security will be rejected by the Procuring Entity.

38. Return of Tender Security

38.1 No Tender Securities shall be returned by the Tender Opening Committee (TOC) during and after the opening of the Tenders.

38.2 No Tender Security shall be returned to the Tenderers before contract signing, except to those who are found unsuccessful.

38.3 Unsuccessful Tenderer's tender security will be discharged or returned as soon as possible but within 28 days of the end of the tender validity period specified in ITT Sub-Clauses 33.1.

38.4 The tender security of the Successful Tenderer will be discharged upon the Tenderer's furnishing of the performance security pursuant to ITT Clause 33 and signing the Agreement.

39. Forfeiture of Tender Security

39.1 The Tender Security 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 Clause 33 and 34; or
(b) refuses to accept a Notification of Award as stated under ITT Sub Clause 63.1; or
(c) fails to furnish Performance Security as stated under ITT Sub Clause 64.1 and 64.2; or
(d) refuses to sign the Contract as stated under ITT Sub Clause 69.2 ; or
(e) Does not accept the correction of the Tender price following the correction of the arithmetic errors as stated under ITT Clause 55.

40. Format and Signing of Tender

40.1 The Tenderer shall prepare one (1) original of the documents comprising the Tender as described in ITT Clause 24 and clearly mark it "ORIGINAL." In addition, the Tenderer shall prepare the number of copies of the Tender, as specified in the **TDS** and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the ORIGINAL shall prevail.

40.2 Alternatives, if permitted in accordance with ITT Clause 26, shall be clearly marked "Alternative".

40.3 The original and each copy of the Tender 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 authorization shall be attached to the Tender Submission Letter (**Form PW3-1**). 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 or initialled by the person signing the Tender.

40.4 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

41. Sealing, Marking and Submission of Tender

41.1 The Tenderer shall enclose the original in one (1) envelope and all the copies of the Tender, including the alternatives, if permitted under ITT Clause 26, in another envelope, duly marking the envelopes as "ORIGINAL" "ALTERNATIVE" (if permitted) and "COPY." These sealed envelopes will then be enclosed and sealed in one (1) single outer envelope.

41.2 The inner and outer envelopes shall:

(a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 42.1;
(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 22nd December **-2014 at 15:30 PM"** the time and date for Tender opening as stated under ITT Sub Clause 48.2;
(e) Bear any additional identification marks as specified in the **TDS**.

41.3 The Tenderer is solely and entirely responsible for pre-disclosure of Tender information if the envelope(s) are not properly sealed and marked.

41.4 Tenders shall be delivered by hand or by mail, including courier services at the address(s) as stated under ITT Sub Clause 42.1.

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

42. Deadline for Submission of Tender

42.1 Tenders shall be delivered to the Procuring Entity at the address specified in the **TDS** and no later than the date and time specified in the **TDS**.

42.2 The Procuring Entity may, at its discretion, extend the deadline for submission of Tender as stated under ITT Sub Clause 42.1, in which case all rights and obligations of the Procuring Entity and Tenderers previously subject to the deadline will thereafter be subject to the new deadline as extended.

42.3 The submission of Tenders will not be allowed in more than one place.

43. Late Tender

43.1 Any Tender received by the Procuring Entity after the deadline for submission of Tenders as stated under ITT Sub Clause 42.1 shall be declared LATE, rejected, and returned unopened to the Tenderer.

44. Notice for Modification, Substitution or Withdrawal of Tender

44.1 A Tenderer 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 42.

45. Tender Modification

45.1 The Tenderer shall not be allowed to retrieve its original Tender, but shall be allowed to submit corresponding modification to its original Tender marked as "**MODIFICATION".**

46. Tender Substitution

46.1 The Tenderer shall not be allowed to retrieve its original Tender, but shall be allowed to submit another Tender marked as **"SUBSTITUTION".**

47. Tender Withdrawal

47.1 The Tenderer shall be allowed to withdraw its Tender by a Letter of Withdrawal marked as **"WITHDRAWAL".**

F. Tender Opening and Evaluation

48. Tender Opening

48.1 Tenders shall be opened in one location, immediately, but no later than one hour, after the deadline for submission of Tenders at the place as specified in the TDS.

48.2 Persons not associated with the Tender may not be allowed to attend the public opening of Tenders.

48.3 The Tenderers' representatives shall be duly authorised by the Tenderer. Tenderers or their authorised representatives will be allowed to attend and witness the opening of Tenders, and will sign a register evidencing their attendance.

48.4 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 44.1.

48.5 Tenders will be opened in the following manner:

(a) First, envelopes marked “Withdrawal” shall be opened and read out and the envelope with the corresponding tender shall not be opened, but returned to the Tenderer. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at tender opening. Next, envelopes marked “Substitution” (S) shall be opened and read out and exchanged with the corresponding tender being substituted, and the substituted tender shall not be opened, but returned to the Tenderer. No Tender substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at tender opening. Envelopes marked “Modification” (M) shall be opened and read out with the corresponding tender. No tender modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at tender opening. Only envelopes that are opened and read out at tender opening shall be considered further.

(b) secondly, the remaining Tenders will be sorted out and those marked “Substitution” or “Modification” will be linked with their corresponding “Original”(O) Tender;

(c) Thirdly, if so specified in this Tender Document, the envelopes marked “Alternative” (A) shall be opened and read aloud with the corresponding Tender and recorded.

48.6 Ensuring that only the correct (M), (S), (A), (O) envelopes are opened, details of each Tender will be dealt with as follows:

(a) the Chairperson of the Tender Opening Committee will read aloud each Tender and record in the Tender Opening Sheet (TOS) :

(i) the name and address of the Tenderer;
(ii) state if it is a withdrawn, modified, substituted or original Tender;
(iii) the Tender price;
(iv) any discounts;
(v) any alternatives;
(vi) the presence or absence of any requisite Tender Security; and
(vii) Such other details as the Procuring Entity, at its discretion, may consider appropriate.

(b) Only discounts and alternatives read aloud at the Tender opening will be considered in evaluation.

(c) All pages of the original version of the Tender, except for un-amended printed literature, will be initialled by

members of the Tender Opening Committee.

48.7 Upon completion of Tender opening, all members of the Tender Opening Committee and the Tenderers or Tenderer's duly authorised representatives attending the Tender opening shall sign by name, address, designation, the Tender Opening Sheet, 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 Tender Opening Committee and any authorised Consultants and, to the Tenderers immediately.

48.9 The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record under ITT Sub Clause 48.7.

48.10 No Tender will be rejected at the Tender opening stage except the LATE Tenders as stated in the ITT Clause 43.

49. Evaluation of tenders

49.1 Tenders shall be examined and evaluated only on the basis of the criteria specified in the Tender Document.

49.2 The Procuring Entity's **Tender Evaluation Committee** (**TEC**) shall examine, evaluate and compare Tenders that are substantially responsive to the requirements of Tender Documents in order to identify the successful Tenderer.

50. Evaluation process

50.1 The TEC will consider a Tender responsive that conforms in all respects to the requirements of the Tender Document without material deviation, reservation, or omission. The evaluation process should begin immediately after tender opening, following four broad steps:

(a) Preliminary examination
(b) Technical examination and responsiveness
(c) Financial evaluation and price comparison
(d) Post-qualification of the Tender.

51. Preliminary Examination

51.1 The Procuring Entity shall examine the tenders to confirm that all documentation requested in ITT Clause 24 has been provided, to determine the completeness of each document submitted.

51.2 The Procuring Entity shall confirm that the following documents and information have been provided in the tender. If any of these documents or information is missing, the offer shall be rejected.

(a) Tender Submission Letter;
(b) Priced Bill of Quantities;
(c) Written confirmation of authorization to commit the Tenderer; and
(d) Tender Security.

52. Technical Responsiveness and Technical Evaluation

52.1 The Procuring Entity's determination of a tender's responsiveness is to be based on the contents of the tender itself without recourse to extrinsic evidence.

52.2 A substantially responsive tender is one that conforms in all respects to the requirements of the Tender Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

(a) affects in any substantial way the scope, quality, or performance of the Works specified in the Contract; or
(b) limits in any substantial way, or is inconsistent with the Tender Documents, the Procuring Entity's rights or the Tenderer's obligations under the Contract; or
(c) If rectified would unfairly affect the competitive position of other Tenderers presenting substantially responsive tenders.

52.3 If a tender is not substantially responsive to the Tender Document, it shall be rejected by the Procuring Entity and shall not subsequently be made responsive by the Tenderer by correction of the material deviation, reservation, or omission.

52.4 There shall be no requirement as to the minimum number of responsive tenders.

52.5 There shall be no automatic exclusion of tenders which are above or below the official estimate.

52.6 The Procuring Entity shall now examine the tender to confirm that all terms and conditions specified in the GCC and the PCC have been accepted by the Tenderer without any material deviation or reservation.

52.7 The Procuring Entity shall evaluate the technical aspects of the tender submitted in accordance with ITT Clauses 30,31 and 32, to confirm that all requirements specified in Section 7: General Specifications and Section 8: Particular Specifications of the Tender Document have been met without any material deviation or reservation.

52.8 If, after the examination of the terms and conditions and the technical aspects of the tender, the Procuring Entity determines that the tender is not substantially responsive in accordance with ITT Sub-Clauses 52.6 and 52.7, it shall reject the tender.

52.9 Provided that a tender is substantially responsive, the Procuring Entity may request that the Tenderer submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities or

omissions in the tender related to documentation requirements. Such omission shall not be related to any aspect of the rates of the tender reflected in the Priced Bill of Quantities. Failure of the Tenderer to comply with the request may result in the rejection of its tender.

52.10 The TEC may regard a Tender as responsive even if it contains;

(a) minor or insignificant deviations which do not meaningfully alter or depart from the technical specifications, characteristics and commercial terms and, conditions or other mandatory requirements set out in the Tender Document; or
(b) Errors or oversights that if corrected, would not alter the key aspects of the Tender.

53. Clarification on Tender

53.1 The TEC may ask Tenderers for clarification of their Tenders, including information which is historical in nature or breakdowns of unit rates or prices, in order to facilitate the examination and evaluation of Tenders. The request for clarification by the TEC and the response from the Tenderer shall be in writing, and Tender clarifications which may lead to a change in the substance of the Tender or in any of the key elements of the Tender pursuant to ITT Sub Clause 52.2, will neither be sought nor be permitted.

53.2 Changes in the Tender price shall also 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. Restrictions on Disclosure of Information

54.1 After the opening of tenders, information relating to the examination, clarification, and evaluation of tenders and recommendations for award shall not be disclosed to tenderers or other persons not officially concerned with the evaluation process until the award of the contract is announced.

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

55. Correction of Arithmetical Errors

55.1 Provided that the Tender is substantially responsive, the TEC shall correct arithmetical errors on the following basis:

(a) if there is a discrepancy between the unit price and the line item total price that is obtained by multiplying the unit price and quantity, the unit price will prevail and the line item total price 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; and

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

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

55.2 If the Tenderer determined to be the lowest evaluated tenderer does not accept the correction of errors, its tender shall be disqualified and its tender security may be forfeited.

56. Financial evaluation

56.1 The TEC will evaluate each Tender that has been determined, up to this stage of the evaluation, to be substantially responsive to the requirements set out in the Tender Document.

56.2 To evaluate a Tender, the TEC will consider the following:

(a) the Tender price, excluding Provisional Sums and the provision, if any, for contingencies in the priced Bill of Quantities, but including Day work items, where priced competitively;
(b) adjustments for correction of arithmetical errors pursuant to ITT Sub Clause 55.1;
(c) adjustments in order to take into consideration the unconditional discounts or methodology for application of the discount offered pursuant to ITT Sub Clause 27.7;
(d) Adjustments for any other acceptable variations or deviations pursuant to ITT Sub Clause 52.10.

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

56.4 The estimated effect of any price adjustment provisions under GCC Clause 71, applied over the period of execution of the Contract, will not be taken into account in Tender evaluation.

56.5 If so indicated in the ITT Sub Clause 1.1 the Procuring Entity may award one or multiple lots to one Tenderer following the methodology specified in ITT Sub Clause 56.6.

56.6 To determine the lowest-evaluated lot or combination of lots, the TEC will take into account:

(a) the experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual lot;
(b) the lowest-evaluated Tender for each lot calculated in accordance with all the requirements of Evaluation Criteria;
(c) the price reduction on account of discount per lot or combination of lots and the methodology for application of the discount as offered by the Tenderer in its Tender; and
(d) the Contract-award sequence that provides the optimum economic combination on the basis of least overall cost of the total Contract package taking into account any limitations due to constraints in Works or execution capacity determined in accordance with the post-qualification criteria stated under ITT Clause 59.

56.7 If the tender, which results in the lowest evaluated Tender Price, is Substantially below the updated official estimate or seriously unbalanced as a result of front loading in the opinion of the Procuring Entity, the Procuring Entity may require the Tenderer to produce details price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated Contract payments, the Procuring Entity may require that the amount of the performance security set forth in ITT Clause 64 be increased at the expenses of the Tenderer to a level sufficient to protect the Procuring Entity against financial loss in the event of default of the successful Tenderer under the Contract.

57. Price Comparison

57.1 The TEC will compare all substantially responsive Tenders to determine the lowest-evaluated Tender, in accordance with ITT Clause 56.

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

57.3 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 Procuring Entity as stated under ITT Sub Clause 57.2, then the Tenderer shall be selected, subject to firm confirmation through the Post-qualification process, after consideration as to whether the Tenderer has demonstrated in its Tender superior past performance with the other Procuring Entities or a more efficient work programme and work methodology.

57.4 The successful Tenderer as stated under ITT Sub Clauses 57.1, 57.2 and 57.3 shall not be selected through **lottery** under any circumstances.

58. Negotiations

58.1 No negotiations shall be held during the Tender evaluation or award with the lowest or any other Tenderer.

58.2 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 estimate; the reasons for such higher price being duly Analysed.

58.3 If the Procuring Entity decides to negotiate for reducing the scope of the requirements under ITT Sub Clause 58.2, 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.

58.4 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 rejecting the proposed award.

59. Post-qualification

59.1 The Procuring Entity shall determine to its satisfaction whether the Tenderer that is selected as having submitted the lowest evaluated and substantially responsive tender is qualified to perform the Contract satisfactorily.

59.2 The determination shall be based upon an examination of the documentary evidence of the Tenderer's qualifications submitted by the Tenderer, pursuant to ITT Clause 32, clarifications in accordance with ITT Clause 53 and the qualification criteria indicated in ITT Clauses 12 to 17. Factors not included therein shall not be used in the evaluation of the Tenderer's qualification.

59.3 An affirmative determination shall be a prerequisite for award of the Contract to the Tenderer. A negative determination shall result in rejection of the Tenderer's Tender, in which event the Procuring Entity shall proceed to the next lowest evaluated tender to make a similar determination of that Tenderer's capabilities to perform satisfactorily

59.4 The TEC may verify information contained in the Tender by visiting the premises of the Tenderer as a part of the post qualification process, if practical and appropriate.

60. Procuring Entity's Right to accept any or to reject any or All Tenders

60.1 The Procuring Entity reserves the right to accept any tender, to annul the tender proceedings, or to reject any or all tenders at any time prior to contract award, without thereby incurring any liability to Tenderers, or any obligations to inform the Tenderers of the grounds for the Procuring Entity's action.

61. Informing Reasons for Rejection

61.1 Notice of the rejection will be given promptly within seven (7) days of decision taken by the Procuring Entity to all Tenderers and, the Procuring Entity 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

62. Award Criteria

62.1 The Procuring Entity shall award the Contract to the Tenderer whose offer is responsive to all the requirements of 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 in accordance with ITT Clause 59.

62.2 A Tenderer will not be required, as a condition for award, to undertake responsibilities not stipulated in the Tender documents, to change its price, or otherwise to modify its Tender.

63. Notification of Award

63.1 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 Procuring Entity shall issue the Notification of Award (NOA) to the successful Tenderer.

63.2 The Notification of Award, attaching the contract as per the sample (**Form PW3-7**) to be signed, shall state :

(a) the acceptance of the Tender by the Procuring Entity;
(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.

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

64. Performance Security

64.1 The Performance Security shall be provided by the successful Tenderer in the amount as specified in the **TDS** and denominated in the currencies in which the Contract Price is payable.

64.2 The Procuring Entity may increase the amount of the Performance Security above the amounts as stated under ITT Sub Clause 64.1 but not exceeding twenty five (25) percent of the Contract price, if it is found that the Tender is substantially below the updated official estimated or seriously unbalanced as a result of front loading as stated under ITT Sub Clause 56.7.

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

65. Form and Time Limit for Furnishing of Performance Security

65.1 The Performance Security, as stated under ITT Clause 64, may be in the form of a Bank Draft, Pay Order or an irrevocable Bank Guarantee in the format (**Form PW3-9**), issued by any scheduled Bank of Bangladesh acceptable to the Procuring Entity.

65.2 Within fourteen (14) days from the date of acceptance of the Notification of Award (NOA) but not later than the date specified therein, the successful Tenderer shall furnish the Performance Security for the due performance of the Contract in the amount as stated under ITT Sub Clauses 64.1 or 64.2.

66. Validity of Performance Security

66.1 The Performance Security shall be required to be valid until a date twenty eight (28) days beyond the Intended Completion Date as specified in Tender Document.

67. Authenticity of Performance Security

67.1 The Procuring Entity may verify the authenticity of the Performance Security submitted by the successful Tenderer by sending a written request to the branch of the bank issuing the Pay Order, Bank Draft or irrevocable Bank Guarantee in specified format.

68. Adjudicator

68.1 The Procuring Entity proposes the person named in the **TDS** to be appointed as Adjudicator under the Contract, at an hourly fee and for those reimbursable expenses specified in the **TDS**.

69. Contract Signing

69.1 At the same time as the Procuring Entity issues the Notification of Award (NOA), the Procuring Entity will send the draft Contract Agreement and all documents forming the Contract to the successful Tenderer.

69.2 Within twenty-one (21) days of receipt of the Agreement, but not later than twenty–eight (28) days of issuance of the NOA, the successful Tenderer shall sign, date, and return it to the Procuring Entity.

69.3 Failure of the successful Tenderer to submit the Performance

Security, pursuant to ITT Sub-Clause 64.1, or sign the Contract, pursuant to ITT Sub-Clause 69.2, shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security. In that event the Procuring Entity may award the Contract to the next lowest evaluated Tenderer, whose offer is substantially responsive and is determined by the Procuring Entity to be qualified to perform the Contract satisfactorily.

70. Publication of Notification of Award of Contract

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

70.2 Notification of Award for Contracts below Taka ten (10) million, shall be published by the Procuring Entity on its Notice Board and where applicable on the website of the Procuring Entity and that notice shall be kept posted for not less than a month.

71. Debriefing of Tenderers

71.1 Debriefing of Tenderers by Procuring Entity 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, without disclosing information about any other Tenderer.

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

72. Right to Complain

72.1 Any Tenderer has the right to complain in accordance with Section 29 of the Public Procurement Act 2006 and Part 12 of Chapter Three of the Public Procurement Rules, 2008.

Tender Data Sheet

Section 2. Tender Data Sheet

ITT Clause	Amendments of and Supplements to Clauses in the Instructions to Tenderers
	A. General
ITT 1.1	The Procuring Entity is: Bangladesh Economic Zones Authority (BEZA) represented by the Project Director, Bangladesh Economic Zones Development Project (Phase- I) BDBL Bhaban, Level -15 12 Kawran Bazaar, Dhaka
	The Name of the Tender is: Construction of 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station (MRSS) Mongla Economic Zone under Bagerhat District. Brief Description of the Works: **Construction of 33 kV Over Head Transmission line, 33 / 11 kV Main Receiving sub Station** with, 33/11 kV step down power transformer, station transformer, Vacuum circuit breaker, isolators, Current transformer, voltage transformer, lightning arrester, post insulator, pin insulator, control and relay panel, structural steel work, earth mat, earth pit, light mast, AAAC conductor, end clams, aluminium bus bar, area lighting, construction control room, Earth works, construction of civil foundation work, soak pit, illumination work, etc. i,e 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station Tender Ref: 03.762.014.00.05.014.2014-81 Date: 19 /01/ 2015 Lot No(s): 1
ITT 3.1	The source of public funds is International Development Association (IDA) & Department for International Development (DFID) through the project Private Sector Development Support Project Development Support Project.
ITT 3.3	The Bank means IDA
ITT 4.3	Guidelines: Procurement under IBRD Loans and IDA Credits (May 2004 and revised in October, 2006 and May 2010), hereinafter referred to as the Procurement Guidelines
ITT 5.1	Tenderers from the following countries are not eligible : **Israel**
ITT 6.1	Materials, Equipment and associated services from the following countries are not eligible: **Israel**
	B. Tender Document
ITT 8.2	The following are authorised agents of the Procuring Entity for the purpose of issuing the Tender Document : **Project Director** Bangladesh Economic Zones Development Project (Phase- I) **Address:** Bangladesh Economic Zones Authority (BEZA) BDBL Bhaban, Level-15, 12- Kawran Bazaar, Dhaka Telephone No.: 8180125 Fax No.: 8180172 e-mail address: bezaprojectgov@gmail.com

<table>
<tr><td>ITT 9.1</td><td>For <u>clarification of Tender Document purposes</u> only, the Procuring Entity's address is:

Attention: ABM Abdul Fattah
Address: Project Director, Bangladesh Economic Zones Development Project (Phase- I)
Bangladesh Economic Zones Authority (BEZA).
Telephone No.: 8180125
Fax No.: 8180172
e-mail address : bezaprojectgov@gmail.com</td></tr>
<tr><td>ITT 10.1</td><td>A Pre-Tender meeting shall be held:

Date: 11th February 2015 , Time: 15:00 hour local
Venue:
BEZA Conference Room
BDBL Bhaban, Level-15, 12 Kawran Bazaar , Dhaka</td></tr>
<tr><td colspan="2">C. Qualification Criteria</td></tr>
<tr><td>ITT 14.1(a)</td><td>The minimum number of years of general experience of the Tenderer in the construction works shall be 3 (Three) years counting backward from the date of tender opening with having adequate experience of Construction of 33 kV transmission lines and 33kV/11kV MRSS</td></tr>
<tr><td>ITT 14.1(b)</td><td>The minimum specific experience in construction works of at least 2 (Two) contracts of similar nature, complexity and methods/construction technology successfully completed within the last 5 (Five) years counting backward from the date of Tender opening, each with a value of at least BDT 600 (Six hundred) Lakh.</td></tr>
<tr><td>ITT 15.1(a)</td><td>The tenderer shall have a minimum average annual construction turnover of any best of 5 (five) years during the last 10 (ten) years counting backward from the date of tender opening amounting to BDT 1200 (One thousand and two hundred) Lakh</td></tr>
<tr><td>ITT 15.1(b)</td><td>The minimum amount of liquid assets or working capital or credit facilities in the form of bank confirmed credit certificate already available to the Tenderer shall be BDT 200 (Two hundred) Lakh.</td></tr>
<tr><td>ITT 16.1(a),</td><td>A Construction Project Manager, Engineer, and other key staff shall have the following qualifications and experience:

<table>
<tr><th>Sl. No</th><th>Designation, Basic Educational Qualifications & No. Of Positions</th><th>Total Works Experience (years)</th><th>In Similar Works Experience (years)</th></tr>
<tr><td>1</td><td>Project Manager- B.sc in Electrical Engineer -1 Person</td><td>Min. 15 years.</td><td>Min. 5 years.</td></tr>
<tr><td>2</td><td>Field Engineer - B.sc in Electrical Engineer -1 Person</td><td>Min. 10 years.</td><td>Min. 5 years.</td></tr>
<tr><td>3</td><td>Site Supervisor – (Diploma –in-Electrical Engineer – 2 persons</td><td>Min. 5 years.</td><td>Min. 3 years.</td></tr>
<tr><td>4</td><td>Surveyor (Certificated in Surveying) -1 Person</td><td>Min. 5 years.</td><td>Min. 3 years</td></tr>
<tr><td>5</td><td>Work Assistant-HSC- 2 Persons</td><td>Min. 5 years.</td><td>Min. 3 years</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>ITT 17.1</td><td>The Tenderer shall own or have proven access to hire or lease of the major construction equipment, in full working order as follows :

<table>
<tr><th>No</th><th>Equipment type and characteristics</th><th>Minimum Number Required</th></tr>
<tr><td>1</td><td>Excavator</td><td>1</td></tr>
<tr><td>2</td><td>Tractor with Tipper</td><td>3</td></tr>
<tr><td>3</td><td>Motor grader</td><td>1</td></tr>
<tr><td>4</td><td>Vibratory rollers</td><td>1</td></tr>
<tr><td>5</td><td>Welding machine</td><td>Min. 3 No.</td></tr>
<tr><td>7</td><td>3 /10 T Crane</td><td>Min.1 No.</td></tr>
<tr><td>8</td><td>Drilling machine with stand</td><td>Min.1 No.</td></tr>
<tr><td>9</td><td>Water Pump (12-16 Hp)</td><td>Min. 1 No.</td></tr>
</table></td></tr>
<tr><td>ITT 18.1</td><td>The value of non-judicial stamp for execution of the Joint Venture agreement shall be BDT. 300</td></tr>
<tr><td>ITT 18.2</td><td>The minimum qualification requirements of Leading Partner and other Partner(s) of a JVCA shall be as follows :

<table>
<tr><th>TDS Clauses references</th><th>Requirements by summation</th><th>Requirements for Leading Partner</th><th>Requirements for other Partner(s)</th></tr>
<tr><td>ITT-14.1(a)</td><td>Summation not applicable</td><td>Same as stated in TDS</td><td>Same as for Leading Partner</td></tr>
<tr><td>ITT-14.1(b)</td><td>100%</td><td>At least one Contract</td><td>Not applicable</td></tr>
<tr><td>ITT-15.1(a)</td><td>100%</td><td>40%</td><td>25%</td></tr>
<tr><td>ITT-15.1(b)</td><td>100%</td><td>Not applicable</td><td>Not applicable</td></tr>
<tr><td>ITT-16.1(a)</td><td>100%</td><td>Not applicable</td><td>Not applicable</td></tr>
<tr><td>ITT-17.1</td><td>100%</td><td>Not applicable</td><td>Not applicable</td></tr>
</table></td></tr>
<tr><td>ITT 19.3</td><td>The Nominated Subcontractor(s) named [insert name(s)] shall execute the following specific components of the proposed Works: Not applicable</td></tr>
<tr><td colspan="2">D. Tender Preparation</td></tr>
<tr><td>ITT 24.1 (l)</td><td>The Tenderer shall submit with its Tender the following additional documents:

1. Valid trade license for the year 2014-15
2. Certificate of latest income tax clearance /Tax return submission with TIN Number
3. VAT Registration Certificate
4. Original letter naming the person authorized to Sign on behalf of the tenderer
5. Original Money Receipt of purchasing the tender document
6. Certificate on liquid asset from a scheduled Bank
7. Work Completion Certificate of similar Works
8. Key staffs & Equipment List.
9. Site Visit / Survey report (if any)
10. Summary/Consolidated audit report showing annual construction turnover for the last 5 (Five) years.
11. Work schedule preferably in the bar chart</td></tr>
<tr><td>ITT 26.1</td><td>Alternatives will not be permitted.</td></tr>
<tr><td>ITT 26.2</td><td>There shall not be alternative times for completion of the Works.</td></tr>
</table>

ITT 26.4	Alternative technical solutions for any parts of works will not be permitted.
ITT 27.9	The prices quoted by the Tenderer shall be fixed for the duration of the Contract.
ITT 28.1	The currency of the Tender shall be: **Bangladesh Taka**
ITT 31.1	The required Technical Proposal shall include the following additional information : Proposed method of construction and Technical Specifications.
ITT 33.1	The Tender Validity period shall be **120** (One Hundred Twenty) days.
ITT 35.1	The amount of the Tender Security shall be BDT 20 (Twenty) Lakh in favour of Project Director, Support to Development of Economic Zone at Mongla, Bangladesh Economic zone Authority (BEZA).
ITT 40.1	In addition to the original of the Tender, two *(2)* copies shall be submitted.
E. Tender Submission	
ITT 41.2(e)	The inner and outer envelopes shall bear the following additional identification marks: BEZA WD-16
ITT 42.1	For **Tender submission purposes** only, the Procuring Entity's address is: Attention: Project Director, Bangladesh Economic Zones Development Project (Phase- I) Address**:** Bangladesh Economic Zone Authority (BEZA), BDBL Bhaban, Level-15, 12- Kawran Bazaar, Dhaka **The deadline for the submission of Tenders is**: **25th February /2015** **Time & Date: 14:00 hours local time**
F. Tender Opening and Evaluation	
ITT 48.1	The Tender opening shall take place at : Conference Room, BDBL Bhaban, Level-15 , 12- Kawran Bazaar, Dhaka Address: Bangladesh Economic Zone Authority (BEZA), BDBL Bhaban, Level-15 12- Kawran Bazaar, Dhaka **Time & Date: 14 :30 hours local time on 26th February /2015**
G. Contract Award	
ITT 64.1	The amount of Performance Security shall be Ten [10%] percent of the Contract Price.
ITT 68.1	The Adjudicator proposed by the Procuring Entity is. Engr. xxxxxxxx, xxxxxxx department. The hourly fee shall be BDT 1000.00 (one thousand) and the reimbursable expenses shall be limited to BDT. 1,00,000.00 (one lakh). The biographical data of the Adjudicator is: Engr. xxxxxxxxxx. xxxxxxxxxxxxxxxx xxxxxx department, Bangladesh. Cell phone:+88- xxxxxxxxxx Phone: +88-xxxxxxxxx E-mail: xxxxxxxx@xxxxxxxx, yyyyyyyyy@yyyyyyyyyy [A brief CV is attached.]

General Conditions of Contract

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) **Act means** The Public Procurement Act, 2006.

(b) **Adjudicator** is the expert appointed jointly by the Procuring Entity and the Contractor to resolve disputes in the first instance, as provided for in GCC Sub Clause 94.2.

(c) **The Bank** means International Development Association (IDA)

(d) **Bill of Quantities (BOQ)** means the priced and completed Bill of Quantities forming part of the Contract defined in GCC Clause 60.

(e) **Compensation Events** are those defined in GCC Clause 69.

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

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

(h) **Completion Date** is the actual date of completion of the Works and Physical services certified by the Project Manager, in accordance with GCC Clause 80.

(i) **Contract** 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 execute, complete, and maintain the Works.

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

(k) **Contractor** is the party whose Tender to carry out the Works has been accepted by the Procuring Entity.

	(l) **Contract Price** is the price stated in the Notification of Award and thereafter as adjusted in accordance with the provisions of the Contract. (m) **Contractor's Tender** is the completed Tender Document including the priced Bill of Quantities and the Schedules submitted by the Contractor to the Procuring Entity. (n) **Day** means calendar day unless otherwise specified as working days. (o) **Day works** 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) **Defects Correction Certificate** is the certificate issued by the Project Manager upon correction of defects by the Contractor. (r) **Defects Liability Period** is the period specified in the PCC and calculated from the Completion Date. **Drawings** include calculations and other information provided in Section 9 or as approved by the Project Manager for the execution and completion of the Contract. (s) **Goods** mean the Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate. (a) **Equipment**. Is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works. (t) **GCC** means the General Conditions of Contract. (u) **Government** means the Government of the People's Republic of Bangladesh. (v) **"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; (w) **Intended Completion Date** is the date calculated from the

	Commencement Date as specified in the **PCC**, 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. (x) **Materials** means things of all kinds other than Plant intended to form or forming part of the Works, including the supply-only materials, if any, to be supplied by the Contractor under the Contract. (y) **Month** means calendar month. (z) **Initial Contract Price** is the Contract Price stated in the Procuring Entity's Notification of Award. (aa) **PCC** means the Particular Conditions of Contract. (bb) **Plant** means the apparatus, machinery and other equipment intended to form or forming part of the Works, including vehicles purchased for the Procuring Entity and relating to the construction of the Works and Physical services. (cc) **Procuring Entity** is the party who employs the Contractor to carry out the Works, as specified in the PCC. (dd) **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 Works and Physical services and administering the Contract. (ee) **Provisional Sums means** amounts of money specified by the Procuring Entity in the Bill of Quantities which shall be used, at its discretion, for payments to Nominated Subcontractor(s) and for meeting other essential expenditures under the Contract pursuant to GCC Sub Clause 77. (ff) **Site** means the places where the Works are to be executed including storage and working areas and to which Plant and Materials are to be delivered, and any other places as may be specified in the **PCC** as forming part of the Site. (gg) **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. (hh) **Specification** means the Specification of the Works

	included in the Contract and any modifications or additions to the specifications made or approved by the Project Manager in accordance with the Contract. (ii) **Start Date** is the date defined in the **PCC** and it is the last date when the Contractor shall commence execution of the Works under the Contract. (jj) **Sub contractor** 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. (kk) **Temporary Works** means all temporary works of every kind other than Contractor's Equipment required on the Site for the execution and completion of the Works and remedying of any defects. (ll) A **Variation** is an instruction given by the Project Manager that varies the Works. (mm) **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. (nn) **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 Procuring Entity 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 and 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. Included under the Contractor which the Project manager certifies to be due 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 PW3-8**); (b) the Notification of Award (**PW3-7**); (c) the completed Tender and the appendix to the Tender; (d) the Particular Conditions of Contract; (e) the General Conditions of Contract; (f) the Technical Specifications; (g) the General Specifications; (h) the Drawings; (i) the priced Bill of Quantities and the Schedules; and (j) Any other document listed in the **PCC** forming part of the Contract.
7. Scope of Works	7.1 The Works to be executed, completed and maintained shall be as specified in the Bill of Quantities, the General and Particular Specifications and Drawings. 7.2 Unless otherwise stipulated in the Contract, the Works shall include all such items not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for completion of the Works as if such items were expressly mentioned in the Contract.
8. Assignment	8.1 Neither the Contractor nor the Procuring Entity shall assign, in whole or in part, its obligations under the Contract
9. Eligibility	9.1 The Contractor and its Sub contractor(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 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 shown in the tender or in the Contract, have been given or received in connection with the procurement process or in the Contract execution.
11. Confidential Details	11.1 The Contractor's and the Procuring Entity's personnel shall disclose all such confidential and other information as may be reasonably required in order to verify the Contractor's compliance with the Contract and allow its proper implementation. 11.2 Each of them shall treat the details of the Contract as private and

	confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.
12. JVCA	12.1 If the Contractor is a Joint Venture, Consortium, or Association (JVCA), (a) each partner of the JVCA shall be jointly and severally liable for all liabilities and ethical or legal obligations to the Procuring Entity for the fulfilment of the promises of the Contract; (b) the JVCA 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 JVCA; (c) The JVCA shall notify the Procuring Entity of its composition and legal status which shall not be altered without the prior approval of the Procuring Entity. (d) 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 works.
13. Possession of the Site	13.1 The Procuring Entity 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 Procuring Entity will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event as stated under GCC Sub Clause 69.1(a).
14. Access to the Site	14.1 The Contractor shall allow the Project Manager and any person authorised by the Project Manager 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. Procuring Entity's Responsibilities	15.1 The Procuring Entity shall pay the Contractor, in consideration of the satisfactory progress of execution and completion of the Works and Physical 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 Agreement.
	15.2 The Procuring Entity shall make its best effort to guide and assist the Contractor in obtaining, if required, any permit, licence, and approvals from local public authorities for the purpose of execution of the Works and Physical services under the Contract.

16. Approval of the Contractor's Temporary Works	16.1	The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, who is to approve them, if they comply with the Specifications and Drawings.
	16.2	The Contractor shall be responsible for design of Temporary Works.
	16.3	The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.
	16.4	The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.
17. Contractor's Responsibilities	17.1	The Contractor shall execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract Agreement.
18. Taxes and Duties	18.1	The Contractor shall be entirely responsible for all taxes, duties, fees, and other such levies imposed inside and outside Bangladesh.
19. Contractor's Personnel	19.1	The Contractor shall employ the key personnel named in the Schedule of Key Personnel, as referred to in the **PCC**, to carry out the functions stated in the Schedule or other personnel approved by the Project Manager.
	19.2	The Project Manager will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are equal to or higher than those of the personnel named in the Schedule.
	19.3	If the Project Manager asks the Contractor to remove a particular person who is a member of the Contractor's staff or work force from the Site, he or she shall state the reasons, and the Contractor shall ensure that the person leaves the Site within three (3) days and has no further connection with the work in the Contract.
20. Subcontracting	20.1	Subcontracting the whole of the Works 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.
	20.2	The prior consent, in writing, of the Project Manager shall however be obtained for other proposed Subcontractor(s).
	20.3	Subcontractors shall comply with the provisions of GCC Clause 39.
21. Nominated Subcontractor	21.1	Nominated Subcontractor named in the Contract shall be entitled to execute the specific components of the Works stated

		in the **PCC**.
	21.2	The Contractor shall not be under obligations to employ a Nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Project manager 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.
	21.3	Subcontracting shall in no event relieve the Contractor from any of its obligations, duties, responsibilities, or liability under the Contract and all Subcontractors shall comply with the provisions of GCC Clause 39.
22. Other Contractors	22.1	The Contractor shall cooperate and share the Site with other Contractors, public authorities, utilities, the Project Manager and the Procuring Entity 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 Procuring Entity may modify the Schedule of other Contractors, and shall notify the Contractor of any such modification.
23. Project Manager's Decisions	23.1	Except where otherwise specifically stated in the **PCC**, the Project Manager will decide Contractual matters between the Procuring Entity and the Contractor in its role as representative of the Procuring Entity.
24. Delegation	24.1	The Project Manager may delegate any of his duties and responsibilities to his representative except to the Adjudicator, after notifying the Contractor, and may cancel any delegation, without retroactivity, after notifying the Contractor.
	24.2	Any communications to the Contractor in accordance with such delegation shall have the same effect as if it was given by the Project Manager.
25. Instructions,	25.1	The Contractor shall carry out all instructions of the Project Manager that comply with the applicable law.
26. Queries about the Contract conditions	26.1	The Project Manager, on behalf of the Procuring Entity, will clarify queries on the Conditions of Contract.
27. Safety, Security and Protection of	27.1	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.
28. Working Hours	28.1 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.
29. Welfare of Labourers	29.1 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.
	29.2 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.
	29.3 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 Procuring Entity may effect payments to the labourers and recover the cost from the Contractor.
30. 30. Child Labour	30.1 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 labour laws and other relevant treaties ratified by the government.
31. 31. Discoveries	31.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Procuring Entity. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.
32. Procuring Entity's and Contractor's	32.1 The Procuring Entity carries the risks that the Contract states are Procuring Entity's risks and the Contractor carries the risks that

Risks		the Contract states are Contractor's risks.
33. Procuring Entity's Risks	33.1	From the Start Date until the Defects Correction Certificate has been issued, the following are Procuring Entity'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 Procuring Entity or by any person employed by or Contracted to him except the Contractor. (b) the risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Procuring Entity or in the Procuring Entity's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.
	33.2	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 Procuring Entity'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 Procuring Entity's risk; or (c) The activities of the Contractor on the Site after the Completion Date.
34. Contractor's Risks	34.1	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 Procuring Entity's risks are Contractor's risks.
35. Copyright	35.1	The copyright in all drawings, documents, and other materials containing data and information furnished to the Procuring Entity by the Contractor herein shall remain vested in the Contractor, or, if they are furnished to the Procuring Entity 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.
	35.2	The Contractor shall not, except for the purposes of performing the obligations under the Contract, without the written permission of the Procuring Entity disclose or make use of any specification,

	plan, design and drawing, pattern, sample or information furnished by or on behalf of the Procuring Entity.
36. Limitation of Liability	36.1 Except in cases of criminal negligence or wilful misconduct: (a) the Contractor shall not be liable to the Procuring Entity, whether in Contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Procuring Entity; and (b) the aggregate liability of the Contractor to the Procuring Entity, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective Works, or to any obligation of the Contractor to indemnify the Procuring Entity with respect to patent infringement.
37. Insurance	37.1 The Contractor shall provide, in the joint names of the Procuring Entity and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles specified in the **PCC** for the following events which are due to the Contractor's risks: (a) loss of or damage to the Works, Plant, and Materials; (b) loss of or damage to Equipment; (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and (d) Personal injury or death.
	37.2 The Contractor shall deliver policies and certificates of insurance to the Project Manager, for the Project Manager's approval, before the Start Date. All such insurances shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.
	37.3 If the Contractor does not provide any of the policies and certificates required, the Procuring Entity may effect the insurance which the Contractor should have provided and recover the premiums the Procuring Entity has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
	37.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager.
	37.5 Both parties shall comply with conditions of the insurance policies.

38. Management and Progress Meetings	38.1 Either the Project Manager or the Contractor may require the other to attend a management and progress meeting. The business of such meeting shall be to review the progress and plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
	38.2 The Project Manager shall record the business of the meetings and provide copies of the record to those attending the meeting and to the Procuring Entity. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management and progress meeting or after the meeting, and stated in writing to all concerned.
39. Corrupt, Fraudulent, Collusive, Coercive, or Obstructive Practices	39.1 The Government and the Bank requires that Procuring Entity, as well as the Contractor shall observe the highest standard of ethics during the implementation of procurement proceedings and the execution of the Contract under public fund.
	39.2 For the purposes of GCC Sub Clause 39.3, 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 a 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 a 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 a Procuring Entity 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. (e) "obstructive practice" 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; and also means acts intended to materially impede the exercise of the inspection and audit rights provided for under GCC Sub-Clause 39.6.
	39.3 Should any corrupt, fraudulent, collusive, coercive or obstructive practice of any kind, in competing for or in executing the Contract, is determined by the Procuring Entity, then the Procuring Entity may, upon giving 28 days' notice to the Contractor, terminate the Contractor's employment under the Contract and expel the contractor from the site, and the provisions of Clause 89 shall apply as if such expulsion had been made under sub-clause 89.1 (Termination for Default).
	39.4 Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with Clause 19.3.

	39.5 The Contractor shall be aware of the provisions on corruption, fraudulence, collusion, coercion and obstruction of the Procurement Guidelines of The Bank, Public Procurement Act 2006 and Public Procurement Rules 2008. 39.6 The Contractor (including its suppliers, sub-contractors, agents, personnel, consultants, and service providers) shall permit the Government and/or the Bank to inspect the Contractor's accounts and records and other documents relating to the submission of tender and contract performance, and to have them audited by auditors appointed by the Government and/or the Bank, if so required. The Contractor's attention is drawn to GCC Sub-Clause 39.3 which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under this sub-clause constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility under the Procurement Guidelines of the Bank).
B. Time Control	
40. Commencement of Works	40.1 Except otherwise specified in the **PCC** , the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Project Manager's instruction recording the agreement of both Parties on such fulfilment and instructing to commence the Works is received by the Contractor: (a) signing of the Contract Agreement by both parties upon approval of the by relevant authorities; (b) possession of the Site given to the Contractor as required for the commencement of the Works; and (c) Receipt by the Contractor of the Advance Payment under GCC Clause 75 provided that the corresponding Bank Guarantee has been delivered by the Contractor, if any.
	If the Project Manager's instruction is not received by the Contractor within one hundred eighty (180) days from the date of signing of the Contract Agreement, the Contractor shall be entitled to terminate the Contract under GCC Sub Clause 90.1.
	40.2 The Contractor shall commence the execution of the Works as soon as is reasonably practicable by the **Start Date** as specified in the GCC Sub Clause **1.1(nn)** after the Commencement Date, and shall then proceed with the Works with due expedition and without delay.
41. Completion of works	41.1 The Contractor shall carry out the Works in accordance with the Programme of Works submitted by the Contractor and as updated with the approval of the Project Manager as stated under GCC Clause 42 to complete them in all respects by the Intended Completion Date.

42. Programme of works	42.1 Within the time stated in the **PCC**, the Contractor shall submit to the Project Manager for approval a Programme of Works showing the general methods, arrangements, order, and timing for all the activities in the Works. The programme may be in the form of an Implementation Schedule prepared in any software or other form acceptable to the Project Manager.
	42.2 The Contractor shall submit to the Project Manager for approval of an updated Programme at intervals no longer than the period stated in the **PCC**. An update of the Programme shall be a Programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.
	42.3 If the Contractor does not submit an updated Programme of Works at the intervals as stated under GCC Sub Clause 42.2, the Project Manager may withhold an amount as stated in the **PCC** from the next payment certificate and continue to withhold this amount until the next due payment after the date on which the overdue Programme of Works has been submitted.
	42.4 The Project Manager's approval of the Programme of Works shall not alter the Contractor's obligations. The Contractor may revise the Programme and submit it to the Project Manager again at any time for approval. A revised Programme shall show the effect of Variations and Compensation Events.
43. Pro Rata Progress	43.1 The Contractor shall maintain Pro Rata progress of the Works. Progress to be achieved shall be pursuant to GCC Clause 42 and shall be determined in terms of the value of the works done.
44. Early Warning	44.1 If at any time during performance of the Contract, the Contractor or its Subcontractors should encounter events, circumstances, conditions that may adversely affect the quality of the work, increase the Initial Contract Price or delay the execution of the Works, the Contractor shall promptly notify the Project Manager in writing of the delay, it's likely duration, and its cause. As soon as practicable after receipt of the Contractor's notice, the Project Manager shall evaluate the situation, and the Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced.
	44.2 The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Initial Contract price and Completion Date. The Contractor shall provide the estimate and the Project Manager shall further proceed as soon as reasonably possible.
45. 45. Extension of Intended	45.1 The Contractor shall be entitled to an extension of the Intended Completion Date, if and to the extent that completion of the Works

Completion Date	or any part thereof is or will be delayed by Compensation Events or a Variation or Extra Work Order.
	45.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within twenty-one (21) days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the extension of Intended Completion Date.
	45.3 Except in case of Force Majeure, as provided under GCC Clause 85, a delay by the Contractor in the performance of its Completion obligations shall render the Contractor liable to the imposition of Liquidated Damages pursuant to GCC Clause 73, unless an extension of Intended Completion Date is agreed upon, pursuant to GCC Clause 45. 45.4 If the Contractor fails to complete the Works by the Intended Completion Date, as extended by the Project Manager as the case may be, the Contractor shall be liable to pay liquidated damages to the Employer.
46. Delays Caused by Authorities	46.1 If the following conditions apply, namely: (a) the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities, (b) these public authorities delay or disrupt the Contractor's work, and (c) the delay or disruption was unforeseeable; then this delay or disruption will be considered as a cause of delay under GCC Sub Clause 45.1.
	46.2 The Project Manager shall notify the Contractor accordingly keeping the Procuring Entity posted.
47. Acceleration	47.1 When the Procuring Entity wants the Contractor to finish the Works before the Intended Completion Date, the Project Manager will obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Procuring Entity accepts these proposals, the Intended Completion Date will be advanced accordingly and confirmed by both the Procuring Entity and the Contractor.
	47.2 If the Procuring Entity accepts the Contractor's priced proposals for acceleration, they will be incorporated in the Contract Price and treated as a **Variation** under GCC Clause 62.
48. Delays Ordered by the Project Manager	48.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

49. Suspension of Work	49.1 The Project Manager may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.
50. Consequences of Suspension	50.1 If the Contractor suffers delay and/or incurs Cost from complying with the Project Manager's instructions under GCC Clause 49 and/or from resuming the work, the Contractor shall give notice to the Project Manager and shall be entitled subject to GCC Clause 93 to: (a) an extension of time for any such delay, if Completion is or will be delayed and (b) Payment of any such cost, which shall be included in the Contract Price.
	50.2 After receiving this notice, the Project Manager shall proceed to agree or determine these matters.
	50.3 The Contractor shall not be entitled to any extension of time for, or to any payment of the cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with GCC Clause 49.
C. Quality Control	
51. Execution of Works	51.1 The Contractor shall construct, install and carry out the Works and Physical services in accordance with the Specifications and Drawings as scheduled in GCC Clause 6.
52. Examination of Works before covering up	52.1 All works under the Contract shall at all times be open to examination, inspection, measurements, testing and supervision of the Project Manager, and the Contractor shall ensure presence of its representatives at such actions provided proper advance notice is given by the Project Manager.
	52.2 No part of the Works shall be covered up or put out of sight without the approval of the Project Manager. The Contractor shall give notice in writing to the Project Manager whenever any such part of the Works is ready for examination and the Project Manager shall attend to such examination without unreasonable delay.
53. Identifying Defects	53.1 The Project Manager shall check the works executed by the Contractor and notify the Contractor of any Defects found. Such checking shall not relieve the Contractor from his or her obligations. The Project Manager may also instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.
54. Testing	54.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a

	Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.
55. Rejection of Works	55.1 If, as a result of an examination, inspection, measurement or testing, of Works it is found to be defective or otherwise not in accordance with the Contract, the Project Manager may reject the Works by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected Works subsequently complies with the Contract.
56. Remedial Work	56.1 Notwithstanding any test or certification, the Project Manager may instruct the Contractor to: (a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract, (b) remove and re-execute any other work which is not in accordance with the Contract, and (c) Execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.
	56.2 The Contractor shall comply with the instruction issued under GCC Sub Clause 56.1 within a reasonable time, which shall be specified in the instruction, or immediately if urgency is specified under GCC Sub Clause 56.1(c).
	56.3 If the Contractor fails to comply with the instruction issued under GCC Sub Clause 56.2, the Procuring Entity shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall be liable to pay all such costs arising from this failure.
57. Correction of Defects	57.1 The Project Manager shall give notice to the Contractor, with a copy to the Procuring Entity and others concerned, of any Defects before the end of the Defects Liability Period, which begins at Completion Date, and is defined in the **PCC**. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.
	57.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.
58. Uncorrected Defects	58.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected by it, and the Contractor shall remain liable to pay the expenditures incurred on account of correction of such Defect.
D. Cost Control	
59. Contract Price	59.1 The Contract Price shall be as specified in the Contract Agreement subject to any additions and adjustments thereto, or

		deductions there from, as may be made pursuant to Contract
60. Bill of Quantities	60.1	The Bill of Quantities shall contain priced items for the construction, installation, testing, and commissioning work to be done by the Contractor.
	60.2	The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.
61. Changes in the Quantities and Unit Rate or Price	61.1	If the final quantity of the work done for any particular item differs from the quantity in the Bill of Quantities by more than twenty-five percent (25%), provided the change in case exceeds one percent (1%) of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change.
	61.2	If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.
62. Variations	62.1	All Variations and Extra Work Orders under the Contract shall be included in the updated Programme of Works produced by the Contractor.
63. Costing of Variations or Extra Orders	63.1	The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.
	63.2	If the work in the Variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work not above the limit stated in GCC Sub-Clause 61.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.
	63.3	If the Contractor's quotation is found to be unreasonable, the Project Manager may order the Variation and make a change to the Contract price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.
	63.4	If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event under GCC

		Sub Clause 69.
	63.5	The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning under GCC Sub Clause 44.1.
64. Cash Flow Forecasts	64.1	When the Programme of Works is updated under GCC Sub Clause 42.2, the Contractor shall provide the Project Manager with an updated cash flow forecast.
65. Payment Certificates	65.1	The basis for payment certificates shall be Bill of Quantities used to determine the Contract price.
	65.2	The Contractor shall submit to the Project Manager monthly statements of the estimated value of the works executed less the cumulative amount certified previously.
	65.3	The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.
	65.4	The value of work executed shall be determined by the Project Manager.
	65.5	The value of work executed shall include the valuation of Variations or Extra Work Orders, Certified Day works and Compensation Events.
	65.6	The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.
66. Payments to the Contractor	66.1	Payments shall be adjusted for deductions for advance payments and retention. The Procuring Entity shall pay the Contractor the amounts certified by the Project Manager within twenty eight (28) days of the date of each certificate after due adjustments for deductions for advance payments, retention and any other additions or deductions which may have become due under the Contract or otherwise, including those under GCC Clause 93.
	66.2	Items of works quantified in the Bill of Quantities for which no rates or prices have been quoted shall be deemed covered by the amounts at rates and prices of other items in the Contract.
	66.3	Payments due to the Contractor in each certificate shall be made into the Bank Account in any scheduled Bank of Bangladesh of the title of the Contract specified in the **PCC**, nominated by the Contractor in the currency specified in the Contract.
67. Delayed Payment	67.1	If the Procuring Entity makes a late payment, the Contractor shall be paid interest on the late payment in the next payment.

		Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made at the prevailing rate of interest for commercial borrowing for each of the currencies in which payments are made.
	67.2	If an amount certified is increased in a subsequent certificate as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.
68. Payments to Nominated Subcontractor(s)	68.1	The Contractor shall pay to the Nominated Subcontractor(s) the amounts shown on the Nominated Subcontractor's invoices approved by the Contractor which the Project Manager certifies to be due in accordance with the subcontract included under the Contract.
69. Compensation Events	69.1	The following shall be Compensation Events: (a) The Procuring Entity does not give access to or possession of the Site or part of the Site by the Site Possession Date stated in the GCC Sub Clause 13.1; (b) The Procuring Entity modifies the Schedule of other Contractors in a way that affects the works of the Contractor under the Contract; (c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time; (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects; (e) The Project Manager unreasonably does not approve a subcontract to be let, if applicable; (f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Notification of Award from the information issued to Tenderers (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site; (g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Procuring Entity, or additional work required for safety or other reasons; (h) Other Contractors, public authorities, utilities, or the Procuring Entity do not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor; (i) The advance payment is delayed; (j) The effects on the Contractor of any of the Procuring Entity's Risks; (k) The Project Manager unreasonably delays issuing a Completion Certificate;

		(l) A situation of Force Majeure has occurred, as defined in GCC Clause 85; and (m) Other Compensation Events described in the Contract or determined by the Project Manager in the **PCC** shall apply.
	69.2	If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract price shall be increased and whether and by how much the Intended Completion Date shall be extended, only on justifiably acceptable grounds duly recorded.
	69.3	As soon as the Contractor has provided information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost, the Project Manager shall assess it, and the Contract price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract price based on the Project Manager's own forecast. The Project Manager will assume that the Contractor will react competently and promptly to the event.
	69.4	The Contractor shall not be entitled to compensation to the extent that the Procuring Entity's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Project Manager.
70. Adjustments for Changes in Legislation	70.1	Unless otherwise specified in the Contract, if between the date twenty-eight (28) days before the submission of Tenders for the Contract and the date of the last Completion Certificate, 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 approving authorities) that subsequently affects the Completion Date and/or the Contract price, then such Completion Date and/or Contract price shall be correspondingly increased or decreased, to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract.
	70.2	The Project Manager shall adjust the Contract Price on the basis of the change in the amount of taxes, duties, and other levies payable by the Contractor, provided such changes have not already been accounted for in the price adjustment as defined in GCC Clause 69 and/or reflected in the Contract price.
71. Price Adjustment	71.1	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 formula indicated below 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.
		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 payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.
72. Retention Money	72.1	The Procuring Entity may retain from each progressive payment due to the Contractor at the percentage specified in the **PCC** until completion of the whole of the Works under the Contract.
	72.2	On completion of the whole of the Works, the first half the total amount retained under GCC Sub Clause 72.1 shall be repaid to the Contractor and the remaining second half after the Defects Liability Period has passed and the Project Manager has certified in the form of **Defects Corrections Certificate.**
	72.3	On completion of the whole of the Works, the Contractor may substitute an unconditional Bank Guarantee in the format as specified (**Form PW3-11**) acceptable to the Procuring Entity for the second half of the retention money as stated under GCC Sub Clause 72.2.
73. Liquidated Damages	73.1	The Contractor shall pay liquidated damages[16] to the Procuring Entity at the rate per day stated in the **PCC** for each day that the Completion Date is later than the Intended Completion Date.

[16] Usually liquidated damages are set between 0.05 percent and 0.10 percent per day, and the total amount is not to exceed between 5 percent and 10 percent of the Contract Price.

		The total amount of liquidated damages shall not exceed the amount defined in the **PCC**. The Procuring Entity may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.
	73.2	If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rates specified in Sub-Clause 43.1.
74. Bonus	74.1	The Contractor shall be paid a Bonus calculated at the rate per calendar day **if stated in the PCC** for each day (less any days for which the Contractor is paid for acceleration) that the Completion of the whole of the Works is earlier than the Intended Completion Date. The Project Manager shall require certifying that the Works are complete, although they may not have fallen due to being complete as per approved updated Programme of Works.
75. Advance Payment	75.1	If so specified in the **PCC,** the Procuring Entity shall make advance payment to the Contractor of the amounts and by the dates stated in the **PCC** against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Procuring Entity in an amount equal to the advance payment. The Guarantee shall remain effective until the advance payment has been repaid, but the amount of the Guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.
	75.2	The Contractor shall use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used for such specific purposes by supplying copies of invoices or other documents to the Project Manager.
	75.3	The advance payment shall be repaid by deducting at proportionate rate from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.
76. Performance Security	76.1	The Procuring Entity shall notify the Contractor of any claim made against the Bank issuing the Performance Security.

	76.2	The Procuring Entity may claim against the security if any of the following events occurs for fourteen (14) days or more. (a) The Contractor is in breach of the Contract and the Procuring Entity has duly notified him or her ; and (b) The Contractor has not paid an amount due to the Procuring Entity and the Procuring Entity has duly notified him or her.
	76.3	In the event the Contractor is liable to pay compensation under the Contract amounting to the full value of the Performance Security or more, the Procuring Entity may call the full amount of the Performance Security.
	76.4	The Performance Security furnished at the time of signing of the Contract Agreement shall be substituted, after the issuance of certificate of Completion of works by the Project Manager, by a new Security covering fifty (50) percent amount of the Performance Security to cover the Defects Liability Period.
	76.5	If there is no reason to call the Performance Security, the Performance Security shall be discharged by the Employer and returned to the Contractor not later than twenty-eight (28) days after the Defects Liability Period has passed and the Project Manager has certified in the form of **Defects Corrections Certificate.**
77. Provisional Sums	77.1	Provisional Sums shall only be used, in whole or in part, in accordance with the Project Manager's instructions and the Contract price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Project Manager shall have instructed.
	77.2	Plants, Materials or Services to be purchased by the Contractor under the provisions of GCC Sub Clause 77.1 from Nominated Subcontractor(s) or for meeting the other expenditures under the Contract, and for which there shall be included in the Contract price, the actual amounts paid or due to be paid by the Contractor, and a sum for VAT, profit and overhead charges, as applicable, calculated as a percentage of these actual amounts by applying the relevant percentage rate stated in the **PCC**.
	77.3	The Contractor shall, when required by the Project Manager, produce quotations, invoices, vouchers and accounts or receipts in substantiation of purchases under GCC Sub Clause 77.2.
78. Day works	78.1	If applicable, the Day works rates in the Contractor's Tender shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.
	78.2	All works to be paid for as Day works shall be recorded by the

		Contractor on forms approved by the Project Manager. Each completed form shall be certified and signed by the Project Manager within seven (7) days of the works being done.
	78.3	The Contractor shall be paid for Day works subject to obtaining signed Day works forms.
79. Cost of Repairs to Loss or Damages	79.1	Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Liability Period shall be remedied by the Contractor at the Contractor's own cost, if the loss or damage arises from the Contractor's acts or omissions.
E. Completion of the Contract		
80. Completion	80.1	The Contractor shall apply by notice to the Project Manager for issuing a Completion Certificate of the Works, and the Project Manager shall do so upon deciding that the work is completed.
81. Taking Over	81.1	The Procuring Entity shall take over the Site and the Works within seven (7) days of the Project Manager's issuing a certificate of Completion.
82. Amendment to Contract	82.1	The amendment to Contract shall generally include extension of time to the Intended Completion Date, increase or decrease in initial Contract price and any other changes acceptable under the conditions of the Contract.
	82.2	The Procuring Entity, in accordance with the Delegation of Financial Power or sub-delegation thereof, shall amend the Contract incorporating the changes introduced to the original terms and conditions of the Contract in line with the Rules.
83. Final Account	83.1	The Contractor shall submit with a detailed account of the total amount that the Contractor considers payable under the Contract to the Project Manager before the end of the **Defects Liability Period**.
	83.2	The Project Manager shall certify the **Final Payment** within fifty six (56) days of receiving the Contractor's account if the payable amount claimed by the Contractor is correct and the corresponding works are completed.
	83.3	If it is not, the Project Manager shall issue within fifty six (56) days a **Defects Liability Schedule** that states the scope of the corrections or additions that are necessary.
	83.4	If the **Final Account of Works** submitted under GCC Sub Clause 83.1 is unsatisfactory even after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.
84. As-built drawings	84.1	If "As Built" Drawings and/or operating and maintenance

and manuals		manuals are required, the Contractor shall supply them by the dates stated in the **PCC**.
	84.2	If the Contractor does not supply the Drawings and/or Manuals by the dates specified in GCC Sub Clause 84.1, or they do not receive the Project Manager's approval, the Project Manager shall withhold a nominal amount specified in the **PCC** from payments due to the Contractor.
85. Force Majeure	85.1	Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind stated below; (a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies ; (b) rebellion, terrorism, sabotage by persons other than the Contractor's personnel, revolution, insurrection, military or usurped power, or civil war ; (c) riot, commotion, disorder, strike or lockout by persons other than the Contractor's personnel ; (d) 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 (e) Natural catastrophes such as fires, floods, epidemics, quarantine restrictions, freight embargoes, cyclone, hurricane, typhoon, tsunami, storm surge, earthquake, hill slides, landslides, and volcanic activities.
86. Notice of Force Majeure	86.1	If a party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice, within fourteen (14) days after the party became aware, 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.
	86.2	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.
87. Consequences of Force Majeure	87.1	If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under GCC Sub Clause 86, and suffers delay and/or incurs cost by reason of such Force Majeure, the Contractor shall be entitled subject to GCC Sub Clause 93 to: (a) an extension of time for any such delay, if completion is or will be delayed, under GCC Clause 45, and (b) if the event or circumstance is of the kind described sub-paragraphs (a) to (e) of GCC Sub Clause 85.1 occurs in the Country, payment of any such cost, including the costs of rectifying or replacing the Works and Physical services damaged or destructed by Force Majeure, to

	the extent they are not indemnified through the insurance policy referred to in GCC Clause 37.
	87.2 After receiving notice under GCC Sub Clause 86.1, the Project Manager shall proceed to determine these matters under the provisions of the Contract.
88. Release from Performance	88.1 Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the parties to be released from further performance of the Contract, then upon notice by either party to the other party of such event or circumstance: (a) the parties shall be discharged from further performance, without prejudice to the rights of either party in respect of any previous breach of the Contract, and (b) The sum payable by the Procuring Entity to the Contractor shall be the same as would have been payable under GCC Sub Clause 90.3 if the Contract had been terminated under GCC Sub Clause 89.3.
F. Termination and Settlement of Disputes	
89. Termination	89.1 Termination for Default (a) The Procuring Entity 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 Project Manager; (ii) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within eighty four (84) days; (iii) the Project Manager 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 Project Manager; (iv) the Contractor does not maintain a Security, which is required; (v) 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 73; (vi) the Contractor has subcontracted the whole of the Works or has assigned the Contract without the required agreement and without the approval of the Project Manager; (vii) The Contractor, in the judgment of the Procuring Entity has engaged in corrupt or fraudulent practices, as defined in GCC Sub Clause 39, in competing for or in executing the Contract. (viii) A payment certified by the Project Manager is not paid by the Procuring Entity to the Contractor within eighty-four (84) days of the date of the Project Manager's certificate.
	89.2 Termination for Insolvency The Procuring Entity 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.
	89.3 Termination for Convenience (a) The Procuring Entity, 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 Procuring Entity's convenience, the extent to which performance of the Contractor under the Contract is terminated, and the date upon which such termination becomes effective. (b) The Procuring Entity shall not terminate the contract under GCC Sub Clause 89.3 (a) in order to execute the Works 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 89.1(a).
	89.4 In the event the Procuring Entity terminates the Contract in whole or in part, the Procuring Entity 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 Procuring Entity 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 89.3., engage another Contractor to complete the Works, and in that case the Contractor shall be liable to the Procuring Entity 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.
	89.5 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
90. Payment upon Termination	90.1 If the Contract is terminated because of a fundamental breach of Contract under GCC Sub Clause 89.1 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 Procuring Entity exceeds any payment due to the Contractor, the difference shall be a debt payable to the Procuring Entity.
	90.2 If the Contract is terminated for the Procuring Entity's convenience or because of a fundamental breach of Contract by the Procuring Entity, 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.
	90.3 If the Contract is terminated for reasons of Force Majeure, 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 Procuring Entity when paid for by the Procuring Entity, and the Contractor shall place the same at the Procuring Entity'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 labour

	employed wholly in connection with the Works at the date of termination.
91. Property	91.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Procuring Entity if the Contract is terminated because of the Contractor's default stated under GCC Sub Clause 89.1.
92. Frustration	92.1 If the Contract is frustrated by the occurrence of a situation of Force Majeure as defined in GCC Sub Clause 85, the Project Manager 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.
G. Claims, Disputes and Arbitration	
93. Contractor's Claims	93.1 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 Procuring Entity, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, as and not later than twenty eight (28) days after the Contractor became aware, or should have become aware, of the event or circumstance.
	93.2 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 Procuring Entity shall be discharged from all liability in connection with the claim.
	93.3 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 Project Manager, the Contractor shall send to the Project Manager 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.
94. Settlement of Disputes	94.1 **Amicable settlement** The procuring Entity and the Contractor shall use their best efforts to settle amicably all possible disputes arising out of or in connection with this Contract or its interpretation.
	94.2 **Adjudication** (a) If the Contractor believes that a decision taken by the Project Manager was either outside the authority given to the Project Manager by the Contract or that the decision was wrongly taken, the decision shall be referred to the

	Adjudicator within fourteen (14) days of notification of the Project Manager's decision in writing. (b) The Adjudicator named in the **PCC** is jointly appointed by the parties. In case of disagreement between the parties, the Appointing Authority designated in the **PCC** shall appoint the Adjudicator within fourteen (14) days of receipt of a request from either party. (c) The Adjudicator shall give its decision in writing to both parties within twenty-eight (28) days of a dispute being referred to it. (d) The Contractor shall make all payments (fees and reimbursable expenses) to the Adjudicator, and the Procuring Entity shall reimburse half of these fees through the regular progress payments. (e) Should the Adjudicator resign or die, or should the Procuring Entity and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract; a new Adjudicator will be jointly appointed by the Procuring Entity and the Contractor. In case of disagreement between the Procuring Entity and the Contractor the Adjudicator shall be designated by the Appointing Authority within fourteen (14) days of receipt of a request from either party as stated under GCC Sub Clause 94.2 (b)
	94.3 **Arbitration** (a) If the parties are unable to reach a settlement as per GCC Clauses 94.1 and 94.2 within twenty-eight (28) days of the first written correspondence on the matter of disagreement, then either party may give notice to the other party of its intention to commence arbitration in accordance with GCC Sub Clause 97.3(b). (b) The arbitration shall be conducted in accordance with the Arbitration Act (**Act No 1 of 2001**) of Bangladesh as at present in force and in the place shown in the **PCC**.

Particular Conditions of Contract

Section 4. Particular Conditions of Contract

GCC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract
GCC 1.1(k)	The Contractor is *[Name, address, and name of authorized representative]*
GCC 1.1(cc)	The Procuring Entity is BEZA Bangladesh Economic Zone Authority (BEZA) represent by Bangladesh Economic Zones Development Project (Phase- I) Address**:** Bangladesh Economic Zone Authority (BEZA), BDBL Bhaban, Level-15 , 12- Kawran Bazaar, Dhaka Authorized Representative: ABM Abdul Fattah, Project Director, Bangladesh Economic Zones Development Project (Phase- I)
GCC 1.1(dd)	The Project Manager is ABM Abdul Fattah, Project Director, Bangladesh Economic Zones Development Project (Phase- I) Bangladesh Economic Zone Authority (BEZA), Address**:** Bangladesh Economic Zone Authority (BEZA), BDBL Bhaban, Level-15 12- Kawran Bazaar, Dhaka Authorized Representative: Same as Project Manager
GCC 1.1 (z)	The initial Contract price is:..... *[insert the amount in the NOA]*
GCC 1.1(w)	The Intended Completion Date for the whole of the Works shall be 9 (nine) months from the date of Contract.
GCC 1.1(ff)	The Site is located at Mongla, Bagerhat district and is defined in drawings attached.
GCC 1.1(ii)	The Start Date shall be 7 days from the date of Contract Signed.
GCC 1.1(mm)	Work consist of **Construction of 33 kV Over Head Transmission line, 33 / 11 kV Main Receiving sub Station** with, 33/11 kV step down power transformer, station transformer, Vacuum circuit breaker, isolators, Current transformer, voltage transformer, lightning arrester, post insulator, pin insulator, control and relay panel, structural steel work, earth mat, earth pit, light mast, AAAC conductor, end clams, aluminium bus bar, area lighting, construction control room, Earth works, construction of civil foundation work, soak pit, illumination work, etc. i,e Construction of 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station (MRSS) Mongla Economic Zone under Bagerhat District.
GCC 2.5	The Sectional Completion Dates are: N/A
GCC 3.1	The Procuring Entity's address for the purpose of communications under this contract is : Engr. xxxxxxxxx, xxxxxx Engineer (civil), Bangladesh Economic Zone Authority (BEZA) Address: BDBL Bhaban, Level-15 12- Kawran Bazaar, Dhaka Tel: xxxxxxx,xxxxxxx, xxxxxxxxxx Fax: xxxxxxx e-mail address: xxxxxxxxx@xxxxx.xxx

<table>
<tr><td></td><td>The Contractor's address for the purpose of communications under this contract is :</td></tr>
<tr><td>GCC 6.1 (j)</td><td>Other documents forming part of the Contract are: Environmental Management Plan, Work schedule, Schedule of key personnel, Schedule of equipment, Site inspection report & Report of the Technical Monitoring Sub-committee.
A Committee shall be formed by Procuring Entity for advising to properly implementation of construction of electrical works called as "Technical Monitoring Sub-committee". The Contractor must need to verify each stage of electrical works to Technical Monitoring Sub-committee and getting report before construction of the next stage of the work.</td></tr>
<tr><td>GCC 9.1</td><td>A Contractor or a Subcontractor that is a national of, or registered in, the following countries are not eligible: Israel</td></tr>
<tr><td>GCC 9.2</td><td>Materials, Equipments Plants and supplies shall not have their origin in the following countries: Israel</td></tr>
<tr><td>GCC 13.1</td><td>Possession of the Site or part(s) of the Site, to the Contractor shall be given on the following date(s): Seven (7) days from the signing of Contract.</td></tr>
<tr><td>GCC 19.1</td><td>Following Key Personnel to carry out the functions stated in the Schedule shall be employed by the Contractor;
<table>
<tr><th>Sl. No</th><th>Designation, Basic Educational Qualifications & No. Of Positions</th><th>Total Works Experience (years)</th><th>In Similar Works Experience (years)</th></tr>
<tr><td>1</td><td>Project Manager- B.sc in Electrical Engineer -1 Person</td><td>Min. 15 years.</td><td>Min. 5 years.</td></tr>
<tr><td>2</td><td>Field Engineer - B.sc in Electrical Engineer -1 Person</td><td>Min. 10 years.</td><td>Min. 5 years.</td></tr>
<tr><td>3</td><td>Site Supervisor – (Diploma –in-Electrical Engineer – 2 persons</td><td>Min. 5 years.</td><td>Min. 3 years.</td></tr>
<tr><td>4</td><td>Surveyor (Certificated in Surveying) -1 Person</td><td>Min. 5 years.</td><td>Min. 3 years</td></tr>
<tr><td>5</td><td>Work Assistant-HSC- 2 Persons</td><td>Min. 5 years.</td><td>Min. 3 years</td></tr>
</table></td></tr>
<tr><td>GCC 21.1</td><td>Nominated Subcontractor(s) named below:
None
____[insert name(s)]_____
shall be entitled to execute the following specific components of the Works</td></tr>
<tr><td>GCC 23.1</td><td>The Contractual matters between the Procuring Entity and the Contractor shall be decided by : N/A</td></tr>
<tr><td>GCC 27.1(c)</td><td>Shall implement the Environmental Management Plan as specified in Section 10 of the tender document and also comply to the clearance conditions of the Department of Environment.</td></tr>
<tr><td>GCC 37.1</td><td>The minimum insurance cover shall be :
<table>
<tr><td>(a)</td><td>The maximum deductible for insurance of the Works and of Plant and Materials is BDT------- [state amount]
[The Contractor shall provide this amount at the time of Contract signing].</td></tr>
<tr><td>(b)</td><td>The minimum cover for insurance of the Works and of Plant and Materials in respect of the Contractor's faulty design is BDT. 110%</td></tr>
<tr><td>(c)</td><td>The maximum deductible for insurance of Equipment is BDT..... [the Contractor shall provide this amount at the time of Contract signing].</td></tr>
</table></td></tr>
</table>

	(d)	The minimum cover for loss or damage to Equipment is BDT ------ (xxxxx) lakh.
	(e)	The maximum deductible for insurance of other property is BDT lakh. *[The Contractor shall state this amount at the time of Contract signing].*
	(f)	The minimum cover for insurance of other property is BDT ---- .
	(g)	The minimum cover for personal injury or death insurance: (i) For the Contractor's employees is as per the law and common practice in Bangladesh. (ii) And for third parties is as per the law and common practice in Bangladesh.
GCC 40.1	Commencement Date of Works shall be as follows:	
GCC 42.1	The Contractor shall submit a Programme for the Works within 15 (fifteen) days of signing the Contract.	
GCC 42.2	The period between Programme updates is: Every 1 (One) Month.	
GCC 42.3	The amount to be withheld for late submission of an updated Programme is BDT. 100,000 (One lakh).	
GCC 57.1	The Defects Liability Period is 12 (Twelve) months.	
GCC 66.3	1. 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 : xxxxxxx Fax : xxxxxxx e-mail address : xxxxxx@xxxxxxxxx *[information furnished by the Contractor shall be substantiated by the concerned Bank and authenticated by the Procuring Entity]*	
GCC 69.1(m)	The following additional events shall also be the Compensation Events: **Not Applicable**	
GCC 71.1	The Contract is not subject to price adjustment.	
GCC 72.1	The proportion of payments to be retained is **5 (Five)** percent.	
GCC 73.1	The amount of Liquidated Damages or in other words Delay Damages for the uncompleted Works or any part thereof is **0.05 percent** of its Contract price per day of delay.	
GCC 73.1	The maximum amount of Liquidated Damages for the uncompleted Works or any part thereof is Ten (10) percent of the final Contract price of the whole of the Works.	
GCC 74.1	The Bonus for the whole of the Works is [insert percentage] percent of the final Contract price per day: Not Applicable	
	The maximum amount of Bonus for the whole of the Works is [insert percentage] percent of the final Contract price : **Not Applicable**	
GCC 75.1	The Advance Payment shall be BDT [insert amount] and shall be paid to the Contractor not later than: **Not Applicable**	
GCC 77.2	The percentage for adjustment of Provisional Sums is: *None*	
GCC 84.1	The date by which "**as-built**" drawings are required is within thirty (30) days after substantial completion of works.	

	The date by which operating and maintenance manuals are required is within thirty (30) days after substantial completion of works.
GCC 84.2	The amount to be withheld for failing to produce "**as-built**" drawings and/or operating and maintenance manuals by the date required is BDT 80,00,000 (eighty lakh).
GCC 90.1	The percentage to apply to the contract value of the works not completed, representing the Procuring Entity's additional cost for completing the uncompleted Works is: 20 (Twenty) percent.
GCC 94.2 (b)	The Adjudicator jointly appointed by the parties is: Name: Engr. xxxxxxxxxxx, xxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxx department, Bangladesh. Cell phone:+88- xxxxxxxxxx Phone: +88-xxxxxxx E-mail: xxxxxxxxxxxx@xxxxxxxxx, xxxxxxxxxxx@xxxxxxxxxxxxx
GCC 94.2(b)	In case of disagreement between the parties, the Appointing Authority for the Adjudicator is the President of the Institution of Engineers, Bangladesh.
GCC 94.3 (b)	The arbitration shall be conducted in the place mentioned below : Dhaka, Bangladesh

Tender and Contract Forms

Section 5. Tender and Contract Forms

Form	Title
	Tender Forms
PW3 – 1	Tender Submission Letter
PW3 – 2	Tenderer Information
PW3 – 3	JV Partner Information (*if applicable*)
PW3 – 4	Subcontractor Information (*if applicable*)
PW3 – 5	Personnel Information
PW3 – 6	Bank Guarantee for Tender Security (*when this option is chosen*)
	Contract Forms
PW3 – 7	Notification of Award
PW3 – 8	Contract Agreement
PW3 – 9	Bank Guarantee for Performance Security (*when this option is chosen*)
PW3 –10	Bank Guarantee for Advance Payment (*if applicable*)
PW3 –11	Bank Guarantee for Retention Money Security (*when this option is chosen*)

Forms **PW3 -1** to **PW3 -6** comprises part of the Tender Format and should be completed as stated in ITT Clauses 24.

Forms **PW3 -7** to **PW3 -11** comprises part of the Contract as stated in GCC Clause 6.

Tender Submission Letter (Form PW3-1)

[The Tenderer must prepare the Tender Submission Letter in its letterhead.]

[Note: All italicized text is for use in preparing this form and shall be deleted from the final letter]

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, declare that:

(a) We have examined and have no reservations to the Tender Document, including Addenda issued in accordance with Instructions to Tenderers (ITT) clause 11;

(b) We offer to execute in conformity with the Tender Document the following Works and Physical Services:

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

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

(e) Our Tender shall be valid for a period of [***Insert Validity Period as specified in ITT sub-clause 33.1***]_____ days from the date fixed for the tender submission deadline in accordance with the Tender Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) If our Tender is accepted, we commit to obtain a Performance Security in accordance with the Tender Document;

(g) We, including any subcontractors or suppliers for any part of the contract, have or will have nationalities from eligible countries, in accordance with ITT sub-clause 5.1;

(h) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITT sub-clause 5.5;

(i) We are not participating, as a Tenderer or as a subcontractor, in more than one Tender in this Tendering process in accordance with ITT sub-clause 20.1, other than alternative offers submitted in accordance with ITT clause 26;

(j) We, our affiliates or subsidiaries, including any of our subcontractors or suppliers for any part of the contract, have not been declared ineligible by the Bank, under the laws of Bangladesh or official regulations or by an act of compliance with a decision of the United Nations Security Council on charges of engaging in corrupt, fraudulent, collusive, coercive or obstructive practices in accordance with ITT sub clause 5.6;

(k) We confirm that we do not have a record of poor performance as stated in ITT sub 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 PW3-2);

(l) We are not a government owned entity / We are a government owned entity but meet the requirements of ITT sub clause 5.3;

(m) We understand that this Tender, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(n) We understand that you are not bound to accept the lowest evaluated Tender or any other Tender that you may receive; and

(o) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

Signature:	*[insert signature of authorised representative of the Tenderer]*
Name:	*[insert full name of signatory]*
In the capacity of:	*[insert capacity of signatory]*
Duly authorised to sign the Tender for and on behalf of the Tenderer	*[insert the Name of Tenderer]*

Attachment 1: ***[****ITT Sub Clause 40.3,*
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 PW3-2)

[This Form should be completed only 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)]*

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			
	Year	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 32]				
2.1	General Experience in Construction Works of Tenderer				
	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 Tenderer [Prime/Sub/ Management]
2.2	Specific Experience in Construction Works of Tenderer Completed Contracts of similar nature, complexity and methods/construction technology				
	Contract No Name of Contract	[insert reference no] of [insert year] [insert name]			
	Role in Contract *[tick relevant box].*	Prime 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 construction 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		Taka or Equivalent Taka	

2.4	Financial Resources available to meet the construction 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 32.1(a), (b), (c) & (d)

2.5	Contact Details [ITT Sub Clause 32.1 (g) & (i)	
	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 32.1(e)]	
	Position Name Years of General Experience	Years of Specific Experience

[*Tenderer to complete details of above. The Tenderer should complete the Personnel Information Form (Form PW3-5*)]

2.7	Major Construction Equipments proposed to carry out the Contract [ITT Sub Clause 32.1(f)]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, lesser or seller)

[Tenderer to list details of each item of major construction equipment, as applicable]

JVCA Partner Information (Form PW3-3)

[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 32]					
3.1	General Experience in Construction Works 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 [Prime/Sub/Management]
3.2	Specific Experience in Construction Works of JVCA Partner Completed Contracts of similar nature, complexity and methods/construction technology					
	Contract No Name of Contract			[insert reference no] of [insert year] [insert name]		
	Role in Contract [tick relevant box]			Prime 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 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]		
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		Taka or Equivalent Taka		

3.4	Financial Resources available to meet the construction cash flow [ITT Sub-Clause 15.1(b)]		
	No.	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 32.1 (a), (b), (c) & (d)		
3.5	Contact Details [ITT Sub Clause 32.1 (g) & (i)		
	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 32.1(e)]		
	Position Name Years of General Experience	Years of Specific Experience	
	[Tenderer to complete details of above. The Tenderer should complete the Personnel Information Form (Form PW3-5)]		
3.7	Major items of Construction Equipment proposed for carrying out the works [ITT Sub-Clause 32.1(f)]		
	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]			

Subcontractor Information (Form PW3-4)

[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 Work performed	

Personnel Information (Form PW3-5)

[To be filled in for each person proposed by the Tenderer on Form PW3-2 & PW3-3, 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)		
☐	Construction Project Manager	☐ Prime Candidate	☐ Alternative Candidate
☐	Key Personnel	☐ Prime Candidate	☐ Alternative Candidate

B.	**Personal Data**
Name	
Date of Birth	
Years overall experience	
National ID Number, if applicable	
Years of employment with the Tenderer	
Professional Qualifications: 1. 2. 3. 4.	

C.	**Present Employment** *[to be completed only if not employed by the Tenderer]*		
Name of Employer			
Address of Employer:			
Present Job Title:			
Years with present Employer			
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			
4			
5			

Bank Guarantee for Tender Security (Form PW3-6)

[This is the format for the Tender Security to be issued by a scheduled Bank of Bangladesh in accordance with ITT Clause 35 & 36. All italicized text is for guidance on how to prepare this guarantee and shall be deleted from the final document]]

Invitation for Tender No: Date:

Tender Package No:

To:

[Name and address of the Procuring Entity**]**

TENDER GUARANTEE No:

We have been informed that *[name of Tenderer]* (hereinafter called "the Tenderer") intends to submit to you its Tender dated *[date of Tender]* (hereinafter called "the Tender") for the execution of the Works of *[description of works]* under the above Invitation for Tenders (hereinafter called "the IFT").

Furthermore, we understand that, according to your conditions, the Tender must be supported by a Bank Guarantee for Tender Security.

At the request of the Tenderer, we *[name of bank]* hereby irrevocably 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 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); or
c. failed to furnish Performance Security; or

Failed or refused to sign the Contract Agreement

This guarantee will expire

(a) if the Tenderer is the successful Tenderer, upon our receipt of a copy of the Contract Agreement signed by the Tenderer and the a copy of 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.

Consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

Signature Seal of Bank and Signature

Sample Notification of Award (Form PW3-7)

Contract No: Date:
To:

[Name of Contractor]

This is to notify you that your Tender dated *[insert date]* for the execution of the Works for *[name of project/Contract]* for the Contract Price of Tk *[state amount in figures and in words]*, as corrected and modified in accordance with the Instructions to Tenderers, has been approved by *[name of Procuring Entity].*

You are requested to:

i. accept in writing the Notification of Award within seven (7) working days of its issuance pursuant to ITT Sub Clause 63.1
ii. Furnish a Performance Security in the form as specified and in the amount of Tk *[state amount in figures and words],* within fourteen (14) days of acceptance of this Notification of Award but not later than *(specify date),* in accordance with ITT Clause 65.
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 Sub Clause 69.2.

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 Procuring Entity]*

Date:

Contract Agreement (Form PW3-8)

THIS AGREEMENT made the *[day]* day of *[month] [year]* between *[name and address of Procuring Entity]* (hereinafter called "the Procuring Entity") of the one part and *[name and address of Contractor]* (hereinafter called "the Contractor") of the other part:

WHEREAS the Procuring Entity invited Tenders for certain works, viz, *[brief description of works]* and has accepted a Tender by the Contractor for the execution of those works 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 documents forming the Contract shall be interpreted in the following order of priority:
   (a) the signed Contract Agreement
   (b) the Notification of Award
   (c) the completed Tender and the appendices to the Tender
   (d) the Particular Conditions of Contract
   (e) the General Conditions of Contract
   (f) the Technical Specifications
   (g) the General Specifications
   (h) the Drawings
   (i) the priced Bill of Quantities and the Schedules
   (j) Any other document listed in the PCC forming part of the Contract.

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

4. The Procuring Entity hereby covenants to pay the Contractor in consideration of the execution and completion of the works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of Bangladesh on the day, month and year first written above.

For the Procuring Entity	For the Contractor
Signature	
Name	
National ID No. Title	
In the presence of Name	
Address	

Bank Guarantee for Performance Security (Form PW3-9)

[This is the format for the Performance Security to be issued by a scheduled bank of Bangladesh in accordance with ITT Clause 64, 65, 66 & 67. All italicized text is for guidance on how to prepare this guarantee and shall be deleted from the final document]

Contract No: [insert reference number] Date: [insert date]

To:

[insert Name and address of Procuring Entity]

PERFORMANCE GUARANTEE No:

We have been informed that *[name of Contractor]* (hereinafter called "the Contractor") has undertaken, pursuant to Contract No *[insert reference number of Contract]* dated *[insert date of Contract]* (hereinafter called "the Contract"), the execution of works *[description of works]* under the Contract.

Furthermore, we understand that, according to your conditions, the Contract must be supported by a Bank Guarantee for Performance Security.

At the request of the Contractor, we *[name of bank]* hereby irrevocably 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.

This guarantee is valid until *[insert date of validity of guarantee which should be twenty-eight days after the expected completion date; in case of extension of the time of completion, the Procuring Entity would need to get this guarantee extended]*, consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

Signature Seal of the Bank and Signature

Bank Guarantee for Advance Payment (Form PW3-10)

[This is the format for the Advance Payment Guarantee to be issued by a scheduled bank of Bangladesh in accordance with GCC Clause 75. All italicized text is for guidance on how to prepare this guarantee and shall be deleted from the final document]]

Contract No: [insert reference number] Date: [insert date]

To:

[insert Name and address of the Procuring Entity]

ADVANCE PAYMENT GUARANTEE No:

We have been informed that *[name of Contractor]* (hereinafter called "the Contractor") has undertaken, pursuant to Contract No *[insert reference number of Contract]* dated *[insert date of Contract]* (hereinafter called "the Contract"), the execution of works *[description of works]* under the Contract.

Furthermore, we understand that, according to your Conditions of Contract under GCC Clause 75, the Advance Payment on Contract must be supported by a Bank Guarantee.

At the request of the Contractor, we *[insert name of bank]* hereby irrevocably 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 Procuring Entity 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 *[insert 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.

Signature Seal of the Bank and Signature

Bank Guarantee for Retention Money Security (Form PW3-11)

[This is the format for the Retention Money Guarantee to be issued by a scheduled bank of Bangladesh in accordance with GCC Sub Clause 72.3. All italicized text is for guidance on how to prepare this guarantee and shall be deleted from the final document]]

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 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 Works.

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.

Signature

Seal of Bank and Signature

Section 6. Bill of Quantities

Bill of Quantities (BOQ)

Bill no. 1: 33 kV Overhead Transmission line

Name of Works: Construction of 33 kV Single circuit Overhead Transmission line for Mongla EZ

Sl. No.	Description	Unit	Quantity	Quoted rate in Taka		Amount in Taka
				Amount in figures	Amount in words	
1	Supply and erection of 12 Mtr Spun pre stressed concrete pole including earth work, civil works including concreting etc,.	Set	30.00			
2	Fabrication, supply, erection of Horizontal cross arms fabricated out of 100 x 50 x 6 mm channel, hot dipped galvanised including provision of drilled holes as required for insulators fixing, including G.I bolts, nuts and washers etc.,	Set	30.00			
3	supply, erection of 33 kV Pin insulators including fixing of insulators using hard dipped Galvanized iron (G.I) pins, bolts, nuts and washers etc.,	Nos.	90.00			
4	supply, erection of 11 kV Disc insulators with erection hardware, using hard dipped G.I bolts, nuts and washers etc.,	Nos.	108.00			
5	supply, erection of Strain Clamp 3 bolt type for disc insulator	Nos.	36.00			
6	Supply, erection of G.I. Stay set for poles including loop insulators at in accessible height complete with anchor plate 300 x 300 x 6 mm. straining screws. G I stay wire 7/8 SWG G.I stay rod 20 mm x 1.8 Mtr. length and pole clamps including erection.	Set	12.00			
7	supply, and stringing of Coyote (150 Sq.mm) All Aluminium alloy conductor (AAAC)	KM	3.65			
8	supply, erection of PG Clamps suitable for Coyote conductor with erection hardware.	Nos.	12.00			
9	Supply, erection of pipe type earthing with 40mm. dia 3.0 mtr long 'B' grade G.I. pipe complete including inter connecting 6 SWG GI wire, hardware with accessories including masonry work.	Nos.	30.00			

Sl. No.	Description	Unit	Quantity	Quoted rate in Taka		Amount in Taka
				Amount in figures	Amount in words	
10	Supply, erection of Concreting materials for stay sets including earth work etc., all inclusive.	Nos.	12.00			
11	Supply, erection of guarding loops for OHT line with 8 SWG G.I. wire.	Nos.	6.00			
12	supply, erection of Caution / Danger Board as per standards including fixing hardware	Nos.	30.00			
	Supply, erection of anti climbing devices, fabricated from MS Flat 40 x 5 mm, with drooping spikes 15 cm. in length, welded to it and erected on pole.	Nos.	30.00			
				in Lakh (Tk)		

Note

1. It is suggested that the Tenderer uses these sheets of the BOQ in order to avoid any manipulation, distortion and inadvertent mistakes or omissions in course of preparing the Tender by the Tenderer
2. Follow the Guidance notes under **Section 6** in filling this Schedule

Bill no. 2: 33 / 11 kV Main Receiving Sub Station

Name of Works: Construction of 33 / 11 kV Main Receiving Sub Station (MRSS)

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
1.0	**Power Transformer** 8.0MVA ,33KV / 11KV ,ONAN transformer with primary side bushing and secondary side bushing with OLTC arrangement	Nos	2.00					
2.0	Equipment (As per Specification)							
2.1	33KV, 1250A, 31.5KA Vacuum circuit Breaker	No.	3.00					
2.2	33KV, 1250A, 25KA double break Isolator (motor operated) without earth switch	No.	9.00					
2.3	33KV,1250A, 25KA double break Isolator (motor operated) with earth switch manually operated	Nos.	3.00					
2.4	33KV, 10KA station class lightning arrester	Nos.	12.00					
2.5	33KV, 31.5KA, 400-250-100/ 1-1-1-1A,CL - 0.5 - 5P20 - 5P20- PS-PS burden 30VA Current transformer	Nos.	9.00					
2.6	33KV, 31.5KA, 400-250/ 1-1-1-1A,CL - 0.5 - 5P20 - 5P20- PS-PS burden 30VA Current transformer	Nos.	3.00					
2.7	33KV, 31.5KA, 250-100/ 1-1-1A,CL - 0.5 - 5P20 - 5P20 burden 30VA Current transformer	Nos.	6.00					
2.8	33KV /√3/ 110V/√3 -110V - 110V/√3,CL:3P - 3P - 0.5 burden 30 VA Potential Transformer	Nos.	9.00					
2.9	33KV Solid Core Post Insulator	Nos.	18.00					
2.10	11KV VCB(outdoor) 1250A, 25 KA 3 Pole	Nos.	7.00					
2.11	11KV Current Transformer (outdoor) 1000-600/1-1A oil filled - 3 pole	Nos.	6.00					
2.12	11KV Current Transformer (outdoor) 1000A, 400-200-100/1-1A oil filled - 3 pole	Nos.	7.00					
2.13	11KV Lightning arrestor station type	Nos.	6.00					

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
2.14	11KV Lightning arrestor distribution type	Nos.	21.00					
2.15	11KV, 120 KN, Antifog type, disc insulator	Nos.	70.00					
2.16	11kv, 800 A, AB Switch (Double Disconnector) with Post type Insulator 3 pole	Nos	16.00					
2.17	11 KV /√3/110 V/√3 - 110 V/√3 three phase Potential transformer class 0.5 ,20 VA ,5P 10,10 VA	Nos	6.00					
2.18	11 kV Post type insulator	Nos	21.00					
2.19	11 kV Pin Insulator	Nos	24.00					
2.20	33KV /√3/ 110V/√3 class - 0.2 burden ,10 VA Potential Transformer for incoming metering	Nos	3.00					
2.30	33KV, 31.5KA, 250/ 1-1-1A, CL - 0.2 burden 10VA Current transformer for incoming metering.	Nos	3.00					
3.0	**Bulbar Materials**							
3.1	3" IPS Al Tube	Mtr	180.00					
3.2	Zebra ACSR Conductor	Mtr	550.00					
3.3	2" IPS Al Tube	Mtr	60.00					
4.0	**Clamps & connectors**							
4.1	Rigid terminal Connector on ISO for 3" IPS Al Tube	Nos.	24.00					
4.2	Expansion terminal Connector on ISO for 3" IPS Al Tube	Nos.	6.00					
4.3	Rigid/ sliding clamp to suit 75mm Dia. Al. busbar	Nos.	12.00					
4.4	Breaker clamp to suit single ACSR Zebra conductor	Nos.	42.00					
4.5	CT clamp suitable for ACSR Zebra conductor	Nos.	42.00					
4.6	Terminal connector for ACSR Zebra conductor on LAS	Nos.	18.00					
4.7	Switch end clamp to suit ACSR Zebra conductor	Nos.	140.00					
4.8	Rigid/ sliding clamp to suit 75mm Dia. Al. busbar on Transformer	Nos.	6.00					
4.9	Tee connector for IPS Al. on Main and double Zebra on Branch	Nos.	12.00					
4.10	75mm Dia Al. tube Single ACSR Zebra conductor reducer clamp	Nos.	6.00					
4.11	Terminal connector for ACSR Zebra conductor on PT	Nos.	18.00					

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
4.12	TEE Connector for Single Zebra to Single Zebra conductor	Nos.	72.00					
4.13	Transformer clamp on LV side	Nos.	6.00					
4.14	Terminal connector for ACSR Zebra conductor on CT	Nos.	18.00					
4.15	Terminal connector for ACSR Zebra conductor on 11KV breakers	Nos.	12.00					
4.16	Fixed end clamp suitable for 50mm dia. Al tube on Isolator	Nos.	15.00					
4.17	Free end clamp suitable for 50mm dia. Al tube on Isolator	Nos.	15.00					
4.18	Tee clamp suitable for 50mm dia. Al. bus on main and zebra ACSR conductor on branch	Nos.	15.00					
4.19	Terminal connector on 11KV LAS	Nos.	6.00					
4.20	Tension fitting 3 Bolted type	Nos.	18.00					
4.21	Tension fitting 6 Bolted type	Nos.	24.00					
5.0	**CT / PT Junction Boxes / Station PB**	Nos.						
5.1	Marshalling box for busbar protection	No	1.00					
5.2	Marshalling box for AC Supply at 11KV yard	No	2.00					
5.3	Marshalling box for station transformer in 11KV yard	No	1.00					
6.0	**Earthing (To achieve safe step and touch potential and minimum earth resistance as per regulation)**							
6.1	40mm dia. 3.0 meter long MS rod earth electrode with funneling arrangement provision of alternate layers of salt & charcoal along with necessary masonry pit with cover as per standards	Nos.	82.00					
6.2	65 x 10 GI Flat	Mtr	1,560.00					
6.3	50 x 8 GI Flat	Mtr	1,060.00					
6.4	75 x 10 Cu. Flat	Mtr	20.00					
6.5	8 SWG Cu. Wire	Mtr	250.00					
6.6	65sq.mm Braided Copper	Mtr	50.00					
7.0	**Foundation and Civil Works for the following (As Per Specification)**							

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
7.1	Transformer with Soak Pit, Rail etc.,	No.	2.00					
7.2	Lightning mast	Nos.	5.00					
7.3	L.A	Nos.	12.00					
7.4	Isolator	Set	12.00					
7.5	CB	Set	9.00					
7.6	CT	Nos.	34.00					
7.7	PT	Nos.	18.00					
7.8	PI	Nos.	39.00					
7.9	Oil Collection sump with Necessary Pipes	No.	2.00					
7.10	Baffle wall	No	2.00					
7.11	Cable Trench	Mr.	500.00					
8.0	**GI Structural steel**	Ton	30.00					
9.0	**Auxiliary Control Cables (As Per Specification)** Supply and Laying in trench / Trays, Dressing, Testing and Commissioning of 1.1KV grade PVC insulated, Armoured, Cu. Conductor Cables.							
9.1	3C x 2.5Sq.mm Cu	Mtr	200.00					
9.2	4C x 2.5Sq.mm Cu.	Mtr	1,200.00					
9.3	4C x 4Sq.mm Cu.	Mtr	1,200.00					
9.4	7C x2.5Sq.mm Cu	Mtr	100.00					
9.5	14C x 2.5Sq.mm Cu	Mtr	3,000.00					
9.6	20C x 2.5Sq.mm Cu	Mtr	500.00					
9.7	4C x 50 Sq.mm Cu	Mtr	500.00					
9.8	4C x 10 Sq.mm Cu	Mtr	600.00					
10	**Auxiliary Control Cable Termination**							
10.1	3C x 2.5Sq.mm Cu	Mtr	50.00					
10.2	4C x 2.5Sq.mm Cu.	Nos.	200.00					
10.3	4C x 4Sq.mm Cu.	Nos.	300.00					
U	7C x2.5Sq.mm Cu	Mtr	20.00					
10.5	14C x 2.5Sq.mm Cu	Nos.	400.00					
10.6	20C x 2.5Sq.mm Cu	Nos.	50.00					
10.7	4C x 50 Sq.mm Cu	Nos.	20.00					
10.8	4C x 10 Sq.mm Cu	Nos.	20.00					

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
11	**Cable trays and Accessories** Prefabricated hot dip galvanized 2mm thick ladder / Perforated type cable tray, including all necessary bends, tees, reducers, Coupler plates, fasteners etc.,							
11.1	150mm Wide perforated Tray	Mtr.	100.00					
11.2	300mm Wide perforated Tray	Mtr.	100.00					
11.3	450mm Wide Ladder Tray	Mtr.	250.00					
11.4	750mm Wide Ladder Tray	Mtr.	150.00					
11.5	Support Steel - Epoxy Painted	Ton	5.00					
12	**YARD LIGHTING**							
12.1	Supply erecting testing and commissioning of street light poles with 150/250 watts light fixture including junction box.	Nos.	30.00					
12.2	Weather proof Junction box suitable for loop in loop out arrangement for 4C x 6Sq.mm PVC CU. Ar. Cable	Nos.	20.00					
12.3	Flood Light fitting with 400W MH lamp	Nos.	20.00					
			TOTAL - Part-I					
Part -II ; 33 KV SUB STATION & Control Room								
1	**Design, Supply, Installation, Testing and Commissioning of the following**							
2.1	Control and Relay panel (As Per Specification) 33KV indoor Busbar protection panel	No	1.00					
2.2	33/11KV Power Transformer control Panel	No	2.00					
2.3	33/11KV Power Transformer LV C&R Panel	No	2.00					
2.4	11KV Twin feeder C & R Panel	Nos	3.00					
2.5	110V DC annunciator panel Type A	No	1.00					
2.6	AC Panel for 33/11KVSS	No	1.00					
3	**Distribution Boards (As per Specification)**							
3.1	ACDB - 1	No.	1.00					

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
3.2	ACDB - 2	No.	1.00					
3.3	LDB	No.	1.00					
4	**Battery with Battery Charger (As per specification)**							
4.1	300AH,110V, Battery with stand	Set	1.00					
4.2	60A, 110V Battery charger with panels and accessories.	Nos.	2.00					
4.3	Supply, erecting, Testing, and commissioning of 100 KVA, 11/415 V, Dyn11, Transformer with double pole structure arrangements including fencing and civil works as per site conditions.	set	1.00					
5	**Sockets**							
5.1	32A, 3 phase, Weather Proof ,Industrial Type ,Non Metallic Plug and Socket with 32A DP MCB Control	Nos.	5.00					
5.2	20A, 1 Phase, Industrial Type, Non Metallic Plug and socket with 20A DP MCB control.	Nos.	10.00					
6	**Light Fittings**							
6.1	Industrial Reflector Type Fitting with 2 x 28 w FI Lamp	Nos.	20.00					
6.2	Bracket Mounted Street light Fitting with 150W MH lamp with suitable brackets.	Nos.	4.00					
7	**Accessories for Lighting /Sockets**							
7.1	Switch box with 6Nos.6A Switches and 1 No.6A Socket with switch	Nos.	2.00					
7.2	20mm dia., 1.6mm thick GI Conduit with all accessories.	Mtr	200.00					
7.3	Wiring for light points using 3R x 1C x 2.5Sq.mm, PVC Multi strand Cu. Wire in already laid Conduit	Mtr	50.00					
7.4	Wiring for 20A sockets using 3Rx 1C x 4Sq.mm, PVC Multi strand Cu. Wire in already laid Conduit	Nos.	10.00					
8	**Invertor** 5KVA inverter (1Phase Input/output)with 60 Minutes Battery Backup	No.	1.00					

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
9	**LT Cables** Supply and Laying in trench/Trays dressing Clamping, testing and Commissioning of 1.1KV grade XLPE / PVC / AL. Cu. Ar. Conductor Cable of following sizes.							
9.1	3.5C x 185Sq.mm XLPE Al. ar. cable	Mtr	100.00					
9.2	4C x 25Sq.mm XLPE Al. ar. cable	Mtr	50.00					
9.3	4C x 16Sq.mm XLPE Al. ar. cable	Mtr	100.00					
9.4	4C x 6Sq.mm PVC Cu. Ar Cable	Mtr	100.00					
9.5	1C x 70Sq.mm XLPE Al. Ar. Cable(Green with Yellow band)	Mtr	50.00					
10	**LT Terminations** cable and termination for 1.1KV grade XLPE Al. Ar. Conductor cables using double compression gland with Cu. Lugs, bimetallic washers and all consumables material and accessories		1.00					
10.1	3.5C x 185Sq.mm XLPE Al. ar. cable	Nos	6.00					
10.2	4C x 25Sq.mm XLPE Al. ar. cable	Nos.	10.00					
10.3	4C x 16Sq.mm XLPE Al. ar. cable	Nos.	6.00					
10.4	4C x 6Sq.mm PVC Cu. Ar Cable	Nos.	6.00					
10.5	1C x 70Sq.mm XLPE Al. Ar. Cable(Green with Yellow band)	Nos.	20.00					
11	**HT Cables (As per Specification)** Supply, Laying, Dressing, Clamping, Testing and Commissioning of 11KV (E) 1Cx400Sq.mm XLPE Al. ar. cable							
11.1	In Excavated Trench	Mtr	50.00					
11.2	In Built up Trench	Mtr	50.00					
12	**HT Termination**							
12.1	Providing indoor type end termination for the 11KV (E) 3C x 240Sq.mm XLPE Al. Ar. Cable Complete with termination etc.,	Mtr	50.00					
13	**Earthing**							
13.1	100mm dia. 3.0M Long CI Pipe earth electrode with funneling arrangement along with provision of alternate layers of Salt & Charcoal with Necessary masonry	Nos.	2.00					

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
	pit with cover as per IEC- 80							
13.2	50 x 6mm GI Flat	Mtr	100.00					
13.3	8Swg Cu. wire	Mtr	50.00					
14	**Fencing Gate**		1.00					
14.1	Fencing							
	Chain link fencing using 10SWG GI wire with MS angle frame work and Vertical 65 x 65 x 6mm angle supports at 1500mm C/C with a height of 1800mm above formed level at yard with suitable foundation for Verticals.	Mtr	350.00					
14.2	Gate weld mesh gate with Vertical Supports made of 75 x 45 x 6mm angle hinged with Necessary foundation, Locking arrangement with Painting 1500W x 1800Ht	No.	2.00					
14.3	3000W x 1800 Ht	No.	2.00					
15	**Yard Levelling and Gravel Filling for 150 mm thickness and as per requirement**	Sq. Mtr	1,000.00					
TOTAL - Part-II								
Part- III : Safety Items								
	Design, Supply, Installation, Testing and Commissioning of the following							
1	Safety items as per Statutory requirement as per standard (Contractor to Enclose List)	Lot	1.00					
2	Preparation of complete Design calculations for substation equipments, foundation details, detailed engineering for consultants/client's approval	Lot	1.00					
4	Charges for obtaining approval from statutory Authorities	LS	1.00					
5	High Speed water spray system for Transformer	LS	1.00					
6	Permanent Water arrangement system for Earth pits	LS	1.00					
TOTAL - Part-III								

Sl.No	Description	Unit	Qty	Rate in Tk	Amount in Tk	Quoted rate in Taka		Amount in Taka
						Amount in figures	Amount in words	
	Part- IV: Design ,supply and construction of control room							
	Design ,supply and construction of control room							
1	Civil works for control Room including supply of steel, cement complete as per standard / requirements. Contractor should submit the detailed design with standard drawings to Consultant / client's approval before construction.	Sq. mtr	255.00					
2	Capacitor bank suitable for 2 x 8 MVA transformer (6 MVAR)	Lot	1.00					
3	Implementation of Environmental Management Plan	LS	1.00					
	TOTAL - Part-IV							
	Total amount in Tk (Part I+II + III + IV)							

Note

1. It is suggested that the Tenderer uses these sheets of the BOQ in order to avoid any manipulation, distortion and inadvertent mistakes or omissions in course of preparing the Tender by the Tenderer
2. Follow the Guidance notes under **Section 6** in filling this Schedule

Schedule of Day works

Name of Works: _____

IFT No._____ **Package No.** _____**Lot No.**_____

Item no.	Item Code (if any)	Description of Item	Unit	Nominal Quantity	Unit Rate		Amount	
					In figures	In words	In figures	In words
1	***2***	***3***	***4***	***5***	***6***	***7=6***	***5x6***	***9=8***
to be filled in by the Procuring Entity					***o be quoted and filled in by the Tenderer***			
A. DL 100 LABOUR								
DL 101	***01-013-02***	*Labourer*	***Hour***	***1575***				
DL 102		*Mason*	***Hour***	***520***				
DL 103		***Carpenter***	***Hour***	***300***				
& so on		***& so on***						
above are examples only								
Sub-total of 100 for DL 100 LABOUR:								
B. **DM 200 MATERIALS**								
DM 201		***Stone Boulders***	***m3***					
DM 202		***Cement***	***kg***					
DM 203		***GI Pipe***	***m***					
& so on								
above are examples only								
Sub-total of 200 for DM 200 MATERIALS:								
C. **DE 300 CONTRACTOR'S EQUIPMENTS**								
DCE 301		***Excavator***	***Hour***					
DCE 302		***Tractor***	***Hour***					
DCE 303		***Pay loader***	***Hour***					
& so on								
above are examples only								
Sub-total of 300 for DCE 300 CONTRACTOR'S EQUIPMENT :								
GRAND TOTAL OF DAYWORKS (A to C) [Section 6 ; GCC Sub Clause 81]								

Note:

1. Nominal quantities in the schedule shall remain invariable and shall also require prior approval of the authority sanctioning the official estimate.
2. Follow the Guidance Notes under Section 6 in filling this Schedule.

Day work summary

Name of Works: _____

IFT No._____ **Package No.** _____**Lot No.**_____

Classification of Day works	Amount
1. Total for Day work: Labour	
2. Total for Day work: Materials	
3. Total for Day work: Contractor's Equipment	
TOTAL FOR DAYWORKS	
In Figures	
In Words	

Note:

This Summary refers to Schedule of Day works

Grand Summary

Name of Works: Construction of 33 kV Overhead Transmission line, 33 / 11 kV Main Receiving Sub Station (MRSS)

IFT No._____ Package No. _____Lot No._____

Contract Name: _____

Contract No.:_____

General Summary	Reference	Amount
1. Main Items		
2. Day works (if any)		
3. Others (if any)		
TOTAL CONTRACT PRICE FOR THE WORKS	**In figures**	
	In words	

General Technical Specifications

Section 7. General Specifications

.

CONTENTS

ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society of Testing and Materials
BSTI	Bangladesh Standards Testing Institute
BR	Bangladesh Railways
REB	Rural Electrification Board
BRRL	Bangladesh Road Research Laboratory
BS	British Standard
CBR	California Bearing Ratio
HWL	High Water Level
IP	International Petroleum Society
JIS	Japan Industrial Standard
LWL	Low Water Level
MSL	Mean Sea Level
PVC	Polyvinyl Chloride
RHD	Roads and Highways Department
ROW	Right of Way
STP	Standard Laboratory Test Procedures for Quality Control Laboratories,

TECHNICAL SPECIFICATION FOR 36 K.V. VACCUM CIRCUIT BREAKERS (OUTDOOR TYPE)

TECHNICAL SPECIFICATION FOR 36 K.V. VACCUM CIRCUIT BREAKERS (OUTDOOR TYPE)

1.0. Scope

36kV, 1430MVA Circuit Breakers are intended to be purchased for installation at different Sub-stations. Some of the Sub-stations for which equipment are tendered are situated in coastal areas where saline climate prevails. The base structure of the circuit breakers must be galvanized.

1.1. Power supply to auxiliaries

A.C. supply to auxiliaries will be 3 phase, 3 wire, 430 volt or single phase 250 volts at 50 C/s. The voltage variation will be within 10% and the frequency variation ± 5%.

1.2. 33 K.V. circuit breakers type and rating

The circuit breakers shall be vacuum type suitable for outdoor operation under the climatic conditions specified without any protection from sum and rain.

The circuit breaker shall have the following ratings:

Sl. No.	Description in details	Required value
1	Number of poles	3 (One unit with three phase making and breaking)
2	Frequency	50 C/s ± 3 %
3	Nominal system voltage	33 KV rms
4	Highest system voltage	36.0 KV rms
5	Basic insulation level	170 KVP (minimum)
6	Power frequency test Voltage (wet)	75 KV (rms.) (minimum)
7	Nominal Current	1250 Amps rms (minimum)
7a	First pole to clear factor	1.5
8	Breaking capacity	
	(a) Symmetrical	25 KA/1430 MVA (minimum)
	(b)A symmetrical	33 KA Peak
9	Making capacity	62.5 KA Peak
10	Continuous current rating	1250 Amps (RMS) (minimum)
11	Operating Duty	0-0.3 Sec-CO-3 Min-CO
12	(a) Break time	3 Cycles
	(b)Make time	5 Cycles
	(c) Minimum reclosing time	15 Cycle
	(d) Minimum dead time for reclosing	15 Cycle
13	Dry one minute power frequency withstand test voltage	
	a) Between line terminal	75 KV rms (minimum)

Sl. No.	Description in details	Required value
	b) Between line and body	75 KV rms (minimum)
14	Impulse withstand test voltage;	
	a) Between terminal with C.B. open	170 KV (Peak)
	b) Between body & terminal	170 KV (Peak)
15	Insulator or bushing	
	a)Dry one minute power Frequency voltage	75 KV (minimum)
	b)Wet one minute power Frequency withstand Voltage	75 KV (minimum)
	c) Creepage distance	580 mm (Minimum)
16	Short time current	Not less than 25 KA for rating for 3 seconds: 3 seconds.
17	Control circuit voltage	110V D.C

2.0. Standards

The circuit breakers shall comply with the requirements of latest issue of IEC-62271-100, IEC-60694 and other relevant/equivalent standards.

3.0. Climatic conditions

Please refer chapter E3 of Technical Specification on climatic conditions For the purpose of the specification, the limit of ambient temperature shall be 50° C peak and 45° C average over a 24 hours period.

Some of the breakers to be purchased against this specification are intended to be installed on the sea coast having extremely saline climate. Necessary anti corrosive provisions need be incorporated.

4.0. Technical details

4.1. General

a) The circuit breakers shall be of vacuum type. The breakers shall be furnished as a complete unit with all accessories and equipment in place and all internal wiring installed and terminated in the mechanism.

b) The circuit breakers shall provide rapid and smooth interruption of current under all conditions, completely suppressing all undesirable phenomena even under the most severe and persistent short circuit conditions or when interrupting small currents of leading or lagging reactive current. The details of any device incorporated to limit or control the rate of rise of restricting voltages across the circuit breaker contacts shall be stated.

The over voltages caused by the circuit breaker switching on inductive or capacitive load shall not exceed, 2.5 times the normal phase to neutral voltage. The total break time for the circuit breakers throughout the range of their operating duty shall be stated in the tender and guaranteed.

5.0. Constructional features

Each circuit breaker shall comprise 3 identical poles complete with a gang operated mechanism for specified duty. All these poles of the C.B. shall be linked together Electrically, Mechanically for specified duty.

The breaker shall be capable of interruptions of low reactive current (lagging/leading) without undue over voltage and re strike.

a) Control cubicle

A common control cubicle shall be furnished to house electrical controls, monitoring devices and all other accessories. The cubicle shall be of gasket weather proof construction, fabricated from sheet **Aluminium alloy sheet having minimum 3 mm thick. The operating mechanism shall be strong, rigid and not subject to rebound.**

The cubicle shall have front access door with lock and keys and removable gland plate at the bottom for owner's cable entry. Thermostat controlled space heater, internal illumination lamp, 5A 3Pin socket with individual on off switches shall be provided in the cubicle.

6.0. Mounting

The circuit breakers shall be suitable for mounting on steel galvanized structures. The prices of necessary frames for mounting the circuit breaker shall be included with the offer. A ladder should be provided in the circuit breaker structure for easy access to the operating mechanism house. The ladder shall be of M.S with hot dip galvanised.

The circuit breakers shall consist of three identical single phase units with a common operating mechanism. All joints shall be welded so as to have adequate mechanical strength. The breaker porcelain shall be capable of withstanding all pressure resulting from any specified performance of the breaker.

The circuit breaker shall be supplied complete with the necessary lifting tools, foundation bolts and other accessories.

7.0. Temperature rise

The maximum temperature attained by any part of the equipment when in-service at site under continuous full load conditions and exposed to direct rays of sun shall not exceed the permissible limits fixed by approved specifications. When the standards

specifies the limits of temperature rise these shall not exceed when corrected for the difference between ambient temperature at site and the ambient temperature specified in the specification.

8.0. Insulation of the circuit breakers

The insulation to ground, the insulation between open contacts, the insulation between phases of the completely assembled circuit breakers, should be capable of withstanding satisfactorily die-electric test voltages corresponding to basic insulation level specified wheresoever in clause.

8.1. The clearance in open air shall be as follows, unless the apparatus is impulse tested after complete assembly.

i)	Minimum clearance between phase	:	505 mm
ii)	Phase to Earth	:	305 mm
iii)	Minimum clearance between live Parts and grounded object.	:	1400 mm
iv)	Minimum ground clearance to live part	:	3700 mm

9.0. Bushing and insulations

The basic insulation level of the insulating porcelains shall be as specified and shall be suitable for installation in contaminated atmospheres. The porcelains used shall be homogenous and free from cavities and other flaws. They shall be designed to have ample insulation, mechanical strength and rigidity for satisfactory operation under conditions specified above.

The puncture strength of the bushings shall be greater than the flashover value. The bushings shall be entirely free from radio disturbance when operating at a voltage 10% above rated voltage and also be free from external corona.

Adequate means shall be provided to accommodate conductor expansion and there should not be any undue stressing of any part due to temperature change.

10.0. Operation mechanism

10.1. The operating mechanism shall be spring operated type. In case of spring operating mechanism it shall be of motor operated having provision of hand operated spring charging type of by local/remote electric control under normal operation. The mechanism shall be trip from electrically and mechanically. All working parts in the mechanisms shall be corrosion resistant material and all bearings which require greasing shall be equipped with pressure grease fittings.

The mechanism shall be strong, positive, quick in action and shall be removable without disturbing the other parts of the circuit breakers. The mechanisms of breaker shall be such that the failure of any spring will not prevent tripping.

10.2. The operating mechanism along with its accessories shall be mounted in a weather proof cabinet with hinged doors located near the breakers. A local control switch and the breaker position indicator shall be provided in the cabinet. The circuit breakers shall also be provided with means for manual operation for maintenance purposes.

10.3. The control circuits shall be designed to operate on **110V D.C**. It shall be possible to adopt to work on other voltages by simply changing the operating coils. The closing and operating coils shall be designed to operate satisfactorily at any control voltage from 70% to 115% of the normal rated voltage. A heater shall be provided in the cabinet to prevent moisture condensation.

10.4. Necessary cable glands for the cables of the operating mechanism shall be provided.

10.5. All the terminal blocks to be used in the operating mechanism should be of stud type of Poly-amide material of approved make.

10.6. The Motor to be used for spring charging shall be of Universal type and suitable for AC and DC supply (110 V DC).

11.0. Terminal connectors

Technical connectors suitable for the AAAC conductor size 150 Sq mm shall be supplied.

12.0. Auxiliary switches

Spare 10 Nos N/O (normally open) & 10 Nos N/C (normally closed) of auxiliary switches (contacts) shall be provided on each circuit breaker for use in the remote indication and control scheme of the circuit breaker and for providing safety interlocking etc. Special contact for use with trip coil and single short reclosing operation which permits relative adjustment with respect to the travel of the moving contact of the circuit breaker shall also be provided. There shall be provision to add more auxiliary switches at the later date if required.

13.0. Completeness of equipment

Any fittings, accessories or apparatus which may not have been specifically mentioned in those specification but which are usual or necessary in the equipment of similar plant shall be deemed to be included in the contract and shall be supplied by the contractor without extra charges. All plant and equipment shall be complete in all details whether such details are mentioned in the specification or not. The detail bill of materials list to the furnished along with the tender.

14.0. Test

14.1. Type test

All the equipment offered shall be fully type tested as per the relevant standards. In case the equipment of the type and design offered, has already been type tested in

an Govt. Approved test Laboratory, the Contractor shall furnish four sets of type test reports along with the offer. These tests **must not have been conducted earlier than five years from the date of opening of bids**. All the test reports should be submitted during detailed Engg & approval of drawings for verification by the purchaser.

Following type test reports are to be furnished:

Type Tests:--(As per IEC-62271-100)

1) Dielectric Test (LI Voltage, PF Voltage Withstand(Dry&Wet)& etc)
2) RIV Test
3) Measurement of resistance of the main circuit
4) Temperature rise Test
5) Basic short circuit duty test ,Short Time withstand current & Peak withstand current Test
6) 6) Mechanical Operation Test, Mechanical endurance test
7) Out of phase / Short Circuit making & Breaking Test
8) Capacitive Current, Switching Test
    a) cable charging current Test
    b) Single capacitor Bank current switching test
9) Test to verify degree of protection

14.2. Routine tests

1) Dielectric Tests on the main Circuit ,auxiliary & control circuits
2) Measurement of resistance of the main circuit.
3) Design & Visual Checks(Dimensions, clearances & etc)
4) Mechanical operation Test
5) Operating time of the device, motor Characteristics, measurement of coil current & resistance, SF6 gas pressure monitoring, electrical scheme, control Circuit, anti pumping, vacuum interrupter (type, make, etc.), dimensions, name plate details, contact travel & timing checks.

14.3. Acceptance and routine tests

All acceptance and routine tests as stipulated in the relevant standards & above shall be carried out by the supplier in presence of owner's representative.

Immediately after finalization of the programme of **acceptance /routine testing**, the supplier shall give twenty days advance intimation to the purchaser, along with the shop routine test certificate and valid calibration certificates of the equipments/instruments calibrated in a govt. approved test house, to be used during testing for scrutiny, to enable him to depute his representative for witnessing the tests.

15.0. Inspection

The inspection may be carried out by the purchaser at any stage of manufacture. The successful tendered shall grant free access to the purchaser's representative at

a reasonable time when the work is in progress. Inspection and acceptance of any equipments under this specification by the purchaser, shall not relieve the supplier in his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

The supplier shall keep the purchaser informed in advance, about the manufacturing program so that arrangement can be made for inspection.

The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items

16.0. Documentation

All drawings of the VCB shall be furnished to the owner along with the GTP, Type test reports for verification. All dimensions and data shall be in S.I. Units.

List of drawings and documents.

The Contractor shall furnish four sets of following drawings along with his offer.

i) General outline and assembly drawings of the equipment.
ii) Graphs showing the performance of equipments
iii) Sectional views showing :-
    i) General Constructional features.
    ii) The materials/gaskets/sealing used.
    iii) Method of connections.
    iv) Porcelain used and its dimensions along with the mechanical and electrical characteristics.
iv) Arrangement of terminal's and details of connection studs provided.
v) Name Plate.
vi) Schematic drawing
vii) Type test reports in case the equipment has already been type tested.
viii) Test reports, literature, pamphlets of the bought out items, and raw material.

The Contractor shall submit 4 (four sets) of all above said drawings to PMC for approval. The PMC shall communicate his comments/ approval on the drawings and if required, the Contractor through manufacturer shall modify the drawings and resubmit the same for PMC approval for onward submission to Project Manager.

Adequate copies of acceptance and routine test certificates, 4 sets each, duly approved by the Owner /authorised person, shall accompany the dispatched consignment.

The manufacturing of the equipments shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Owner.

4 sets printed and bound volumes of operation, maintenance and erection manuals in English language for each type and rating of equipment supplied shall be submitted by the supplier for distribution, prior to the dispatch of the equipment. The manual shall contain all the drawings and information required for erection, operation and maintenance of the equipment. The manual shall also contain a set of all the approved drawings, type test reports etc.

17.0. Packing and forwarding

The Contractor shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. Any material found short inside the packing cases shall be supplied by the Contractor without any extra cost.

Each consignment shall be accompanied with a detailed packing list containing the following information.

a) Name of the consignee.
   i) Details of consignment.
   ii) Destination
   iii) Total weight of consignment.
   iv) Sign showing upper/lower side of the crate.
   v) Handling and unpacking instructions.
   vi) Bill of material indicating contents of each package.

The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.

Topographical and meteorological site conditions

Location of Installations State of Bangladesh
Altitude 15 m
Maximum Temperature 37°C
Minimum Temperature 12°C
Maximum humidity 100%
Pollution level Medium
Seismic Zone - I
Wind velocity 72m/sec
Maximum rainfall per annum 2786 mm
Average rainfall per annum 1946 mm

TECHNICAL SPECIFICATION FOR 100KVA, 33/0.433KV STATION TRANSFORMER

TECHNICAL SPECIFICATION FOR OUTDOOR TYPE 100 KVA, 33/.433KV STATION TRANSFORMER

1. Scope

1.1. This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of oil immersed, naturally cooled 3 phase **100 KVA, 33kV/ 0.433KV** station transformer for outdoor use.

1.2. It is not the intent to specify completely herein all the details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

1.3. The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. The design shall incorporate every precaution and provision for the safety of equipment as well as staff engaged in operation and maintenance of equipment.

1.4. All outdoor apparatus, including bushing insulators with their mountings, shall be designed so as to avoid any accumulation of water.

2. Standard ratings

2.1. **100 KVA**, **33/0.433 kV** Station Transformers.

3. Standards

3.1. The materials shall conform in all respects to the relevant International Standards, with latest amendments.

3.2. Material conforming to other internationally accepted standards, which ensure equal or better quality than the standards mentioned above, would also be acceptable. In case the bidders who wish to offer material conforming to other standards, the bidders shall clearly bring out the salient points of difference between the standards adopted and the specific standards in relevant schedule.

3.3. Four copies of such standards with authentic English translations shall be furnished along with the offer.

4. Climatic conditions

Please refer chapter E3 of Technical Specification on climatic conditions

Note: The equipment shall generally be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth.

5. Principal parameters

5.1. The transformers shall be suitable for outdoor installation with three phase, 50 Hz, 33 kV system in which the neutral is effectively earthed and they should be suitable for service with **fluctuations in supply voltage up to plus 12.5% to minus 12.5%**

5.2. The transformers shall conform to the following specific parameters:

Sl. No.	33 kV Station Transformers	
1	System voltage (max)	36 kV
2	Rated voltage HV	33 kV +/-6%
3	Rated voltage LV	0.433KV +/-6%
4	Frequency	50Hz +/-5%
5	No. of Phases (minimum)	Three
6	Connection HV	Delta
7	Connection LV	Star (Neutral Brought out)
8	Vector group	Dyn – 11
9	Type of cooling	ONAN

Audible sound levels (decibels) at rated voltage and frequency for liquid immersed transformers shall be as below (NEMA Standards):

KVA rating	Audible sound levels (decibels) maximum
100 KVA	51

6. Technical requirements

6.1. Core material – CRGO

6.1.1. The core shall be stack / wound type of high grade cold rolled grain oriented annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together and to the frames firmly to prevent vibration or noise.

6.1.2. The core shall be stress relieved by annealing under inert atmosphere if required. The complete design of core must ensure permanency of the core loss with continuous working of the transformers. The values of the maximum flux density allowed in the design and grade of lamination used shall be clearly stated in the offer

6.1.3. The bidder should offer the core for inspection and approval by the purchaser during manufacturing stage.

6.1.4. The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and shall not get saturated. The bidder shall **furnish necessary design data** in support of this situation.

6.1.5. **No-load current shall not exceed 3% of full load current and will be measured by energizing the transformer at 433 volts, 50 Hz on the secondary**. **Increase of voltage of 433 volts by 12.5% shall not increase the no-load current by 6% (maximum) of full load current.**

6.1.6. **Flux density within the core should not exceed 1.6 web/sq meter at rated voltage & rated frequency.**

7. Windings

7.1. Material

7.1.1. HV and LV windings shall be wound from Supper Enamel covered / Double Paper covered copper conductor.

7.1.2. LV winding shall be such that neutral formation will be at top.

7.1.3. The winding construction of single HV coil wound over LV coil is preferable.

7.1.4. Inter layer insulation shall be Nomex / Epoxy dotted Kraft Paper.

7.1.5. Proper bounding of inter layer insulation with the conductor shall be ensured. Test for bounding strength shall be conducted.

7.1.6. Dimensions of winding coils are very critical. Dimensional tolerances for winding coils shall be within limits as specified in Guaranteed technical.

7.1.7. Current density for HV and LV winding should not be more that 2.8 Ampere per sq mm at rated current & normal tap.

7.1.8. The core / coil assembly shall be securely held in position to avoid any movement under short circuit conditions.

7.1.9. Joints in the winding shall be avoided. However, if jointing is necessary the joints shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. In case of foil windings, welding of leads to foil can be done within the winding.

8. TAPS

8.1. **Shall be provided, on the higher voltage winding for variation of HV voltage within range of (-) 5.0 % to (+) 7.5% in steps of 2.5%.**

8.2. Changing shall be carried out by means of an **externally operated self position switch and when the transformer is in de- energised condition**.

8.3. Switch position No. 1 shall correspond to the maximum plus tapping. Each tap change shall result in variation of 2.5% in voltage. Provision shall be made for locking the taping switch handle in position. Suitable aluminium anodized plate shall be fixed for tap changing switch to know the position number of tap.

9. Oil

9.1. The insulating oil shall comply with the requirements of BS 148. **Use of recycled oil is not acceptable.** The specific resistance of the oil shall not be less than 2.5 X 1012 ohm-cm at 27^0C when tested as per International standards.

9.2. Oil shall be filtered and tested for break down voltage (BDV) and moisture content before filling.

9.3. The oil shall be filled under vacuum.

9.4. The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

10. Insulation levels

Sl. no	Voltage (kV)	Impulse Voltage minimum (kV Peak)	Power Frequency Voltage minimum (kV)
1	0.433	-	3
2	33	170	70

11. Losses

11.1. The bidder shall guarantee individually the **no-load loss and load loss without any positive tolerance**. The bidder shall also guarantee the total losses at 50% and 100% load condition (at rated voltage and frequency and at 75ºC).

11.2. The following maximum allowable losses at rated voltage and frequency and at 75°C shall be taken:

Voltage Rating	Rating (KVA)	Max. Losses at 50% loading (Watts)	Max. Losses at 100% loading (Watts)
33000/433 - 250 V	100	560	1820

12. Tolerances

12.1. No **positive tolerance** shall be allowed on the maximum losses displayed on the label for both 50% and 100% loading values.

13. Percentage impedance

13.1. The value of percentage impedance of transformer at 75°C at normal tap shall be **5.0% (Minimum)**. **No negative tolerance is allowed.**

14. Temperature rise

The temperature rises over ambient shall not exceed the limits given below:

14.1. Top oil temperature rise measured by thermometer : 35°C

14.2. Winding temperature rise measured by resistance method : 40°C

14.3. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the calculation sheet in this regard.

15. Penalty for non performance

15.1. During testing at supplier's works **if it is found that the actual measured losses are more than the values quoted by the bidder, the purchaser shall reject the transformer and he shall also have the right to reject the complete lot.**

15.2. Purchaser shall **reject the entire lot during the test at supplier's works, if the temperature rise exceeds the specified values**.

15.3. Purchaser shall reject any transformer during the test at supplier's works**, if the impedance values differ from the guaranteed values including tolerance.**

16. Insulation material

16.1. Electrical grade insulation epoxy dotted Kraft Paper / Nomex and pressboard of standard make or any other superior material subject to approval of the purchaser shall be used**.**

16.2. All spacers, axial wedges / runners used in windings shall be made of pre compressed Pressboard-solid, conforming to type B 3.1 of IEC 641-3-2. In case of cross-over coil winding of HV all spacers shall be properly sheared and dovetail punched to ensure proper locking. All axial wedges / runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely.

16.3. Insulation shearing, cutting, milling and punching operations shall be carried out in such a way, that there should not be any burr and dimensional variations.

17. Tank

17.1. The internal clearance of tank shall be such, that it shall facilitate easy lifting of core with coils from the tank without dismantling LV bushings.

17.2. All joints of tank and fittings shall be oil tight and no bulging should occur during service.

17.3. Inside of tank shall be painted with varnish / hot oil resistant paint.

17.4. The top cover of the tank shall be slightly sloping to drain rain water.

17.5. The tank plate and the lifting lugs shall be of such strength that the complete transformer filled with oil may be lifted by means of lifting shackle.

17.6. Manufacturer should carry out all welding operations as per the relevant ASME standards and submit a copy of the welding procedure and welder performance qualification certificates to the customer**.**

17.7. A plain tank

17.7.1 The transformer tank shall be of robust construction rectangular / octagonal / round / elliptical in shape and shall be built up of electrically tested welded mild steel plates of thickness of 6 mm for the bottom & top ;& not less than 4 mm for the sides. Tolerances as per relevant international standards shall be applicable.

17.7.2 In case of rectangular tanks the corners shall be fully welded at the corners from inside and outside of the tank to withstand a pressure of 0.8 kg/cm2 for 30 minutes.

17.7.3 Under operating conditions the pressure generated inside the tank should not exceed 0.4 kg/sq.cm positive or negative.

17.7.4 The tank shall be reinforced by welded flats on all the outside walls on the edge of the tank.

17.7.5 Permanent deflection: The permanent deflection, when the tank without oil is subjected to a vacuum of 525 mm of mercury for rectangular tank and 760 mm of mercury for round tank, shall not be more than the values as given below:

Horizontal length of flat plate in mm	Permanent deflection in mm Maximum
Upto and including 750	5.0
751 to 1250	8.0
1251 to 1750	9.5
1751 to 2000	11.0
2001 to 2250	12.0
2251 to 2500	16.0
2501 to 3000	19.0

17.7.6 The tank shall further be capable of withstanding a pressure of 0.8 kg/sq.cm (g) and a vacuum of 0.7 kg/sq.cm (g) without any deformation.

17.7.7 The radiators can be tube or fin type or pressed steel type to achieve the desired cooling to limit specified temperature rise.

18. Conservator

18.1. The conservator shall be provided on transformers for plain tank.

18.2. When a conservator is provided, oil gauge and the plain or dehydrating breathing device shall be fitted to the conservator which shall also be provided with a drain plug and a filling hole [32 mm (1¼")] normal size thread with cover.

18.3. The dehydrating agent shall be silica gel. The moisture absorption shall be indicated by a change in the colour of the silica gel crystals which should be easily visible from a distance. Volume of breather shall be suitable for 1Kg of silica gel conforming to relevant standards.

18.4. The capacity of a conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to temperature variation.

18.5. The total volume of conservator shall be such as to contain 10% quantity of the oil. Normally 3% quantity the oil shall be contained in the conservator.

18.6. The cover of main tank shall be provided with an air release plug to enable air trapped within to be released, unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

18.7. The inside diameter of the pipe connecting the conservator to the main tank should be within 20 to 50 mm and it should be projected into the conservator so that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to 0°C) should be above the sump level.

19. Surface preparation and painting

19.1. General

19.1.1. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

19.1.2. All primers shall be well marked into the surface, particularly in areas where painting is evident and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to manufacturer's recommendations. However, where ever airless spray is no possible, conventional spray is used with prior approval of purchaser.

19.2. Cleaning and surface preparation

19.2.1. After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.

19.2.2. Steel surfaces shall be prepared by shot blast cleaning to grade Sq. 2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality to relevant standards.

19.2.3. Chipping scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale. These methods shall only be used where blast cleaning is impractical. Manufacturer to clearly explain such areas in his technical offer.

19.3. Protective coating

19.3.1. As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

19.4. Paint material

19.4.1. Following are the types of paint which may be suitably used for the items to be painted at shop and supply of matching paint to site: Heat resistant paint (Hot oil proof) for inside surface.

19.4.2. For external surfaces one coat of thermo setting powder paint or one coat of epoxy primer followed by two coats of synthetic enamel / polyurethane base paint. These paints can be either air drying or stoving.

19.4.3. Also paint as above with one coat of high build Micaceous iron oxide (MIO) as an intermediate coat may be used.

19.5. **Painting procedure**

19.5.1. All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.

19.5.2. Where the quality of film is impaired by excess film thickness (wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coating and apply another coating. As a general rule, dry film thickness should not exceed the specified minimum dry film thickens by more than 25%

19.6. **Damaged paintwork**

19.6.1. Any damage occurring to any part of a painting scheme shall be made good to the same standard of corrosion protection and appearance as that was originally applied.

19.6.2. Any damaged paint work shall be made good as follows:

A. The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.
B. A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.
C. The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

19.7. **Dry film thickness**

19.7.1. To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Over spray, skips, runs, sags and drips should be avoided. The different coats may or may not be of the same colour

19.7.2. Each coat of paint shall be allowed to harden before the next is applied as per manufacturer's recommendation.

19.7.3. Particular attention must be paid to full film thickness at the edges.

19.7.4. The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as given below:

Sl. No.	Paint type	Area to be painted	No. of coats	Total dry film thickness (min.) (microns)
1.	Thermo setting powder paint	Inside Outside	01 01	30 60
2.	Liquid paint i.Epoxy (primer) i. P.U. Paint (Finish coat) i. Hot oil paint / Varnish	Outside Outside Inside	01 02 01	30 25 each 35/10

19.8. **Tests for painted surface**

19.8.1. The painted surface shall be tested for paint thickness.

19.8.2. The painted surface shall pass the cross hatch adhesion test and impact test as acceptance tests and Salt spray test and Hardness test as type test as per the relevant ASTM standards.

Note: Supplier shall guarantee the painting performance requirement for a period of not less than 5 years.

20. Bushings

20.1. The bushings shall conform to the relevant standards specified and shall be of outdoor type. The bushing rods and nuts shall be made of brass material 12 mm diameter for both HT and LT bushings. The tests as per relevant standards shall be conducted on the transformer bushings.

20.2. For 33 kV, 33 kV class bushings; for 0.433 kV, 1.1 kV class bushings shall be used.

20.3. Bushing can be of porcelain /epoxy material. Polymer insulator bushings conforming with relevant IEC can also be used.

20.4. Bushing of plain shades as per relevant standards shall be mounted on the side of the tank and not on top cover.

20.5. Dimensions of the bushings of the voltage class shall conform to the Standards specified and dimension of clamping arrangement shall be as per relevant standards.

20.6. Minimum external phase to phase and phase to earth clearances of bushing terminals shall be as follows:

Voltage Clearance	Phase to Phase	Phase to earth
33 kV	350 mm	320 mm
LV	75 mm	40 mm

The clearances in case of cable box shall be as below:

Voltage Clearance	Phase to Phase minimum	Phase to earth minimum
33 kV ± 6%	351 mm	222 mm
LV	45 mm	20 mm

20.7. Arcing horns shall be provided on HV bushings.

20.8. Brazing of all inter connections, jumpers from winding to bushing shall have cross section larger than the winding conductor. All the Brazes shall be qualified as per ASME, section – IX.

20.9. The bushings shall be of reputed make supplied by those manufacturers who are having manufacturing and testing facilities for insulators.

20.10. The terminal arrangement shall not require a separate oil chamber not connected to oil in the main tank.

21. Terminal connectors

21.1. The HV bushing stems shall be provided with suitable terminal connectors suitable as per relevant standards so as to connect the jumper without disturbing the bushing stem.

21.2. Connectors shall be with eye bolts so as to receive conductor for HV. Terminal connectors shall be type tested as per relevant standards. The terminal arrangement for 433volts side shall be such as to suit 3 ½ X300 mm2 armoured PVC cable.

22. Terminal markings

22.1. High voltage phase windings shall be marked both in the terminal boards inside the tank and one the outside with capital letter 1U, 1V, 1W and low voltage winding for the same phase marked by corresponding small letter 2u, 2v, 2w. The neutral point terminal shall be indicated by the letter 2n. Neutral is to be brought out and connected to local grounding terminal by an earthing strip.

23. Fittings

23.1. The following standard fittings shall be provided:

a. Rating and terminal marking plates, non-detachable.
b. Earthing terminals with lugs – 2 Nos.
c. Lifting lugs for main tank and top cover.
d. Terminal connectors on the HV / LV bushings (For bare terminations only)
e. Thermometer pocket with cap – 1 No.
f. Air release device
g. HV bushings – 3 Nos.,
h. LV bushings – 4 Nos.
i. Pulling lugs.

j. Stiffener
k. Radiators – No. and length may be mentioned (as per heat dissipation calculations) / corrugations.
l. Arcing horns on HT side 3 nos.
m. Prismatic oil level gauge.
n. Drain cum sampling valve.
o. Top filter valve.
p. Oil filling hole having p. 1- ¼" thread with plug and drain plug on the conservator.
q. Silica gel breather.
r. Base channel 100 mm x 50 mm, 460 mm long with holes to make them suitable for fixing on a platform or plinth.
s. 4 Nos. rollers
t. Pressure relief device or explosion vent.

24. Fasteners

24.1. All bolts, studs screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian Standards for metric threads, or the technical equivalent.

24.2. Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals.

24.3. All nuts and pins shall be adequately locked.

24.4. Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.

24.5. All ferrous bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion, by hot dip galvanizing, except high tensile steel bolts and spring washers which shall be electro-galvanized / plated. Appropriate precautions shall be taken to prevent electrolytic action between dissimilar metals.

24.6. Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts and nuts are placed so that they are in accessible by means of ordinary spanners, special spanners shall be provided.

24.7. The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.

24.8. Taper washers shall b provided where necessary.

24.9. Protective washers of suitable material shall be provided front and back of the securing screws.

25. Overload capacity

25.1. The transformers shall be suitable for loading as per relevant standards.

26. Tests

26.1. The type tests as indicated at clause-28 below should have been conducted on a transformer of **same design** during the **last five years on the date of opening of techno-commercial bids**. The bidder shall furnish type test reports during detailed Engineering & drawing approval.

26.2. **The test certificates for all routine and type tests for the transformers and also for the bushings and transformer oil shall be submitted** reports during detailed Engineering & drawing approval.

26.3. The procedure for testing shall be in accordance with relevant standards as the case may be except for temperature rise test.

26.4. Before dispatch each of the completely assembled transformers shall be subjected to the routine tests at the manufacturer's works.

26.5. **Routine tests**

26.5.1. Ratio, polarity, phase sequence, vector group & magnetic balance test.

26.5.2. No Load current and losses at service voltage and normal frequency.

26.5.3. Load losses at rated current and normal frequency.

26.5.4. Impedance voltage test.

26.5.5. Resistance of windings at each tap, cold (at or near the test bed temperature).

26.5.6. Insulation resistance at 60second,600 second & Polarisation Index (P.I i.e ratio of Insulation Resistance taken at 600seconds & at 60 seconds shall not be less than 1.5)

26.5.7. Induced over voltage withstand test.

26.5.8. Separate source voltage withstand test.

26.5.9. Neutral current measurement – The value of zero sequence current in the neutral of the star winding shall not be more than 2% of the full load current.

26.5.10. Oil samples (one sample per lot) to comply with relevant standards.

26.5.11. Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and 112.5% rated voltage.

26.5.12. Pressure & vacuum test for checking the deflection & oil leakage test.

26.6. **Type tests**

Following type test reports are also to be furnished during detailed Engineering & drawing approval. If not furnished than the same will not be accepted for further processing & liable for rejection.

26.6.1. Temperature rise test for determining the maximum temperature rise after continuous full load run. The ambient temperature and time of test should be stated in the test certificate.

26.6.2. Impulse voltage test: with chopped wave of relevant standards.

26.6.3. Short circuit withstand test: Thermal and dynamic ability.

26.6.4. Air Pressure Test: As per relevant standards.

26.6.5. Un-balanced current test: The value of unbalanced current indicated by the ammeter shall not be more than 2% of the full load current.

26.6.6. Noise-level measurement.

26.6.7. Measurement of zero-phase sequence impedance.

26.6.8. Measurement of Harmonics of no-load current.

26.6.9. Transformer tank together with its radiator and other fitting s shall be subjected to pressure corresponding to twice the normal pressure or 0.35 kg / sq.cm whichever is lower, measured at the base of the tank and maintained for an hour.

The permanent deflection of the flat plates after the excess pressure has been released, shall not exceed the figures for vacuum test.

27. Pressure relief device test:

27.1. The pressure relief device shall be subject to increasing fluid pressure. It shall operate before reaching the test pressure as specified in the above class. The operating pressure shall be recorded. The device shall seal-off after the excess pressure has been released.

28. Short Circuit Test and Impulse Voltage Withstand Tests:

28.1. The purchaser intends to procure transformers designed and successfully tested for short circuit and impulse test. In case the transformers proposed for supply against the order are not exactly as per the tested design, the supplier shall be required to carry out the short circuit test and impulse voltage withstand test **at their own cost in the presence of the representative of the purchaser.**

28.2. The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-taking after a short circuit test.

28.3. Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.

28.4. It may also be noted that the purchaser reserves the right to conduct short circuit test and impulse voltage withstand test in accordance with the relevant standards, afresh on each ordered rating at purchaser cost, even if the transformers of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by

the purchaser either at the manufacturer's works when they are offered in a lot for supply or randomly form the supplies already made to purchaser's stores. The findings and conclusions of these tests shall be binding on the supplier.

28.5. Type test certificates for the tests carried out on prototype of same specifications shall be **submitted along with the bid**. The purchaser may select the transformer for type tests randomly.

29. Acceptance test

29.1. **All transformers** shall be subjected to the stage inspection, routine & acceptance test as indicated above in presence of purchaser's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with relevant standards.

29.2. Checking of weights, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workmanship as per GTP and contract drawings.

29.3. Physical verification of core coil assembly and measurement of flux density of one unit of each rating, in every inspection with reference to short circuit test report.

29.4. **Temperature rise test on one unit of the total ordered quantity.-** This test shall be carried out as per relevant standards.

29.5. The pressure & vacuum test on the tank on one unit/lot randomly selected to be carried out as per Sl No. 28.8 & 28.9.

29.6. **Tests at site**

29.6.1. The purchaser reserves the right to conduct all tests on transformer after arrival at site and the manufacturer shall guarantee test certificate figures under actual service conditions.

30. Inspection

30.1. In respect of raw material such as core stampings, winding conductors, insulating paper and oil, supplier shall use materials manufactured / supplied by standard manufacturers and furnish the manufacturers' test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the purchaser. The bidder shall furnish following documents along with their offer in respect of the raw materials:

(a) Invoice of supplier.
(b) Mill's certificate.
(c) Packing list.
(d) Bill of landing.
(e) Bill of entry certificate by custom.

31. Inspection and testing of transformer oil

31.1. To ascertain the quality of the transformer oil, the original manufacturer's tests report should be submitted at the time of inspection. Arrangements should also be made for testing of

transformer oil, after taking out the sample from the manufactured transformers and tested in the presence of purchaser's representative.

31.2. To ensure about the quality of transformers, the inspection shall be carried out by the purchaser's representative at following two stages:-

31.2.1. On line anytime during receipt of raw material and manufacture / assembly whenever the purchaser desires.

31.2.2. At finished stage i.e. transformers are fully assembled and are ready for dispatch.

31.2.3. All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer the Inspector representing the Purchaser all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. this will include Stage Inspection during manufacturing stage as well as Active Part Inspection during Acceptance Tests.

31.2.4. The manufacturer shall provide all services to establish and maintain quality of workmanship in his works and that of his sub-contractors to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of al materials, parts and equipment as per latest quality standards of ISO 9000.

31.2.5. Purchaser shall have every right to appoint a third party inspection to carryout the inspection process.

31.2.6. The purchaser has the right to have the test carried out at his own cost by an independent agency wherever there is a dispute regarding the quality supplied. Purchaser has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation purchaser **have every right to reject the entire lot or penalize the manufacturer, which may lead to blacklisting, among other things.**

32. Documentation

32.1. The bidder shall furnish along with the bid the dimensional drawings of the items offered indicating all the fittings.

32.2. Dimensional tolerances.

32.3. Weight of individual components and total weight.

32.4. An outline drawing front (both primary and secondary sides) and end-elevation and plan of the tank and terminal gear, wherein the principal dimensions shall be given.

32.5. Typical general arrangement drawings of the windings with the details of the insulation at each point and core construction of transformer.

32.6. Typical general arrangement drawing showing both primary and secondary sides and end-elevation and plan of the transformer.

33. Packing and forwarding

33.1. The packing shall be done as per the manufacturer's standard practice. However, it should be ensured that the packing is such that, the material would not get damaged during transit by Rail / Road / Sea.

33.2. The marking on each package shall be as per the relevant standards.

34. Deviation

34.1. The bidders are not allowed to deviate from the principal requirements of the Specifications. However, the bidder is required to submit with his bid in the relevant schedule a detailed list of all deviations without any ambiguity. In the absence of a deviation list in the deviation schedules, it is understood that such bid conforms to the bid specification and no post-bid negotiations shall take place in this regard.

34.2. The discrepancies, if any, between the specification and the catalogues and / or literatures submitted as part of the offer by the bidders, shall not be considered and representations in this regard shall not be entertained.

34.3. If it is observed that there are deviations in the offer in guaranteed technical particulars other than those specified in the deviation schedules then such deviations shall be treated as deviations.

34.4. All the tables shall be prepared by vendor and are to be enclosed with the bid.

ANNEXURE - I

PROFORMA FOR PRE-DELIVERY INSPECTION OF STATION TRANSFORMERS

1. Name of the firm. :

2. Details of offer made :

   (i) Order No. and Date. :

   (ii) Rating. :

   (iii) Quantity. :

   (iv) Sl. No. of transformer. :

3. Date of stage inspection clearance :

4. Reference of stage inspection clearance :

5. Quantity offered and inspected against the order prior to this lot. :

ANNEXURE - II

ROUTINE/ ACCEPTANCE TESTS TO BE CARRIED OUT (CLAUSE-27, 29 ABOVE & IEC*)*

Sl. No.	Particulars	Observations
1.	(a) Ratio Test	AB/an
		BC/bn
		CA/Cn
	(b) Polarity Test, Vector Group, Phase Sequence	
	c) Magnetic Balance	
2.	No load loss measurement	
		Wl
		W2
		W3
	TOTAL	
	Multiplying Factor	
	CT	
	Watt meter	
	Total x MF	
	NET LOSS	
3.	Load loss measurement	
		Wl
		W2
		W3
	Total	
	Multiplying Factors:	
	CT	
	Watt meter	
	PT	
	Total x MF	
	Loss at ambient temperature (watt)	
	Loss at 75º C (with calculation sheet)(watt)	
4.	Winding Resistance:	
	H.V. (In Ohms)	
	(a) At ambient temperature of º C	A-B
		B-C
		C-A
	(b) Resistance at 75º C	A-B
		B-C
		C-A
	L.V. (In Ohms)	
	(a) At ambient temperature of º C	a-b
		c-a

Sl. No.	Particulars	Observations
	(b) Per Phase Resistance at 75º C	a-n
		b-n
		c-n
5.	Insulation Resistance (M ohm)	HV-LV
	60sec,600sec , Polarisation Index(P.I)	HV-E
		LV-E
6.	Separate Source voltage withstand test voltage	
	HV	70 kV for 60 sec.
	LV	3 kV for 60 sec
7.	Induce over-voltage withstand test at double voltage and double frequency.	100 Hz, 866 volts For 60 seconds.
8.	No load current at	
	90% volts	
	100% Volts	
	110% volts	
9.	Unbalance current	
10.	Vector group test	Diagram and readings be shown in separate sheets.
11.	Percentage Impedance at 75º C(Please furnish calculation sheet)	
12.	Transformer oil test (Break down voltage)	
13.	Oil leakage test	
14.	Heat run test	To be carried out once against the order.
15.	Bushing clearance (mm)	HV LV
	(a) Phase to Phase	
	(b) Phase to Earth	
16.	Comments on compliance by the firm on the modifications done as per stage inspection clearance letter issued.	
17.	Whether fittings of the order have been verified	
18.	Whether aluminium die cast silica gel breather with tin container is fitted on the transformers offered.	
19.	Whether engraving of Sl. No. and Name of firm on core clamping channel, side wall and top cover of tank has been verified.	
20.	Whether MS Plate of size 125 x125mm welded on with side of stiffener.	
21.	Whether engraving of name of firm, Sl.No. and Rating of transformer, Order No. and date and Date of Despatch on MS Plate.	
22.	Copy of calibration certificate of metering	

Sl. No.	Particulars	Observations
	equipments be enclosed.	

Note:- If the Purchaser's Inspecting officer wants to note & incorporate any other readings pertaining to the above tests then the same shall have to be incorporated in the test report by the supplier. Also if the inspecting officer decides to carry out any other low voltage tests to know the soundness of the transformer then the same shall have to be carried out by the supplier.

Note: Please ensure that complete details have been filled in the proforma and no column has been left blank.

GUARANTEED AND OTHER PARTICULARS FOR STATION TRANSFORMERS
(GTP to be in Another Annexure)
(To be furnished by the Manufacturer)

Sl. No.	Description
1	Make
2	Name of Manufacturer
3	Place of Manufacture
4	Voltage Ratio
5	Rating in kVA
6	Core Material used and Grade:
	a) Flux density
	b) Over fluxing without saturation (Curve to be furnished by the Manufacturer in support of his claim)
7	Maximum temperature rise of:
	a) windings by resistance method
	b) Oil by thermometer
8	Magnetizing (no-load) current at:
	a) 90% Voltage
	b) 100% Voltage
	c) 110% Voltage
9	Core loss in watts:
	a) Normal voltage
	b) Maximum voltage
10	Resistance of windings at 20ºC,750C
	(with 5% tolerance)
	a) HV Winding (ohms)
	b) LV Winding (ohms)
11	Loan losses (watts) at 75ºC at normal tap(100% Load Condition)
12	Total losses (Load loss +No Load Loss)at 100% load at 75ºC at rated Voltage, frequency & at normal tap.
13	Total Losses at 50% load at 75ºC
14	Current density used for: (Ampere/sq mm)
	a) HV Winding.
	b) LV Winding.
15	Clearances: (mm)
	a) Core and LV
	b) LV and HV
	c) HV Phase to phase
	d) End insulation clearance to earth
	e) Any point of winding to tank.
16	Efficiency at 75ºC
	a) Unity P.F and
	b) 0.8 P.F.
	1) 125ºC load

Sl. No.	Description
	2) 100ºC load
	3) 75ºC load
	4) 50ºC load
	5) 25ºC load
17	Regulation at:
	a) Unit P.F.
	b) 0.8 P.F. at 75ºC
18	% Impedance at 75ºC
19	Flash test:-
	(i) HV 70 kV/ 50HZ for 1 minute
	(ii) LV 3 kV /50 Hz for 1 minutes.
20	Over potential test (Double voltage and
	Double frequency for 1 minute)
21	Impulse test.
22	Mass of : (kg)
	a) Core lamination (minimum)
	b) Windings (minimum)
	c) Tank and fittings
	d) Oil
	e) Oil quantity (minimum) (litre)
	f) Total weight
23	Oil Data:
	1) Quantity for first filling (minimum) (litre)
	2) Grade of oil used.
	3) Maker's name
	4) BDV at the time of filling (kV)
24	Transformer:
	1) Overall length x breadth x height (mm x mm x mm)
	2) Tank length x breadth x height
	3) Thickness of plates for
	a) Side plate (min)
	b) Top and bottom plate (min)
	4) Conservator Dimensions.
25	Radiation:
	1) Heat dissipation by tank walls excluding top and bottom
	2) Heat dissipation by cooling tube
	3) Diameter and thickness of cooling tube.
	4) Whether calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed.
26	Inter layer insulation provided in design for:
	1) Top and bottom layer
	2) In between all layer
	3) Details of end insulation.
	4) Whether wedges are provided at 50ºC turns of the HV coil.

Sl. No.	Description
27	Insulation materials provided.
	a) For Conductors
	(1) HV
	(2) LV
	b) For Core.
28	Material and Size of the wire used.
	1) **HV Dia (mm) (SWG)**
	2) **LV** a) Strip size.
	b) No. of Conductors in parallel
	c) Total area of cross section (sq mm).
29	Whether the name plate gives all particulars as required in tender
30	Particulars of bushings HV/LV
	1) Maker's name
	2) Type
	3) Rating as per relevant standards
	4) Dry power frequency voltage withstand test
	5) Wet power frequency voltage withstand test.

Note:
The following shall be specifically confirmed:

1) Whether the offer conforms to the limits of impedance mentioned in the specification.
2) Whether the offer conforms to the limits of temperature rise mentioned in the specification.
3) Whether the losses of the transformers offered are within the limits specified.
4) Whether the transformer offered is already type tested for the design and test reports enclosed.

Sl. No.	Description	
1.	Core Grade	
2.	Core diameter	mm
3.	Gross core area	Sq cm
4.	Net core area	Sq cm
5.	Flux density	Tesla
6.	Mass of core	Kg
7.	Loss per kg of core at the specified flux density	watt
8.	Core window height	mm
9.	Center to enter distance of the core	mm
10.	No. of LV Turns	
11.	No. of HV turns	
12.	Size of LV conductor bare/covered	mm
13.	Size o HV conductor bare/covered	mm
14.	No. of parallels	
15.	Current density of LV winding.	A/sq mm
16.	Current density of HV winding.	A/sq mm

Sl. No.	Description	
17.	Wt. of the LV winding for Transformer	kg
18.	Wt. of the HV winding for Transformer	Kg
19.	No. of LV Coils/phase	
20.	No. of HV Coils/phase	
21.	Height of LV Winding.	mm
22.	Height of HV Winding.	mm
23.	ID/OD of HV winding	mm
24.	ID/OD of LV winding	mm
25.	Size of the duct in LV winding	mm
26.	Size of the duct in HV winding	mm
27.	Size of the duct between HV and LV	mm
28.	HV winding to LV winding clearance	mm
29.	HV winding to tank clearance	mm
30.	Calculated impedance	%
31.	HV to earth creepage distance	mm
32.	LV to earth creepage distance	mm

TECHNICAL SPECIFICATIONS FOR 33/11KV ONAN POWER TRANSFORMERS

TECHINICAL SPECIFICATION FOR 33/11KV ONAN POWER TRANSFORMERS

1. Scope

1.1. This Specification provides for design, manufacture, assembly, stage inspection, final inspection and testing before despatch, packing and delivery at destination Sub-station by road transport, transit insurance, unloading at site of **8.00 MVA, 33/11kV Power Transformers**, complete with all fittings, accessories, associated equipment, Spares, 10% extra Transformer Oil, required for its satisfactory operation.

The material offered shall be procured from short listed vendor at **E-23** and shall have been successfully Type Tested during last five years on the date of bid opening. The Type Test reports shall be submitted along with the bid.

The Transformer shall be of outdoor type with On Load In-Tank type Tap Changer with RTCC Panel.

1.2. **The core shall be constructed from high grade, non-aging Cold Rolled Grain Oriented (CRGO) Silicon Steel laminations conforming to HIB grade with lamination thickness not more than 0.23mm to 0.27mm** or better quoted grade Core. The maximum flux density in any part of the core and yoke at normal voltage and frequency shall not be more than **1.5 Tesla**.

The Bidder shall provide saturation curve of the core material, proposed to be used. **Laminations of different grade(s) and different thickness (s) are not allowed to be used in any manner or under any circumstances**.

1.3. The Power Transformer shall conform in all respects to highest standards of engineering, design, workmanship based on this specification and the latest revisions of relevant standards at the time of offer. CLIENT shall have the power to reject any work or material, which, in his judgment, is not in full accordance therewith. The Transformer(s) offered, shall be complete with all components, necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether those are specifically brought out in this specification and / or in the commercial order or not.

Client reserves the right to reject the transformer(s)-

i) if on testing the No-load and load- losses exceed the stipulated values as per this Technical Specification
ii) if the temperature rise in oil and / or winding exceeds the value as per this Technical Specification
iii) If impedance value differs from the guaranteed value including tolerance as per this specification
iv) On Inspection and testing, if any of the technical data does not comply to this specification, bid offer and approved drawings etc.

1.4. The offered rating transformer should have been tested for 'Short Circuit withstand capability test' and 'Impulse test' in an NABL accredited Government Laboratory as per relevant IEC and the Type Test certificates in complete shape shall be accompanied with the bid offer.

2. Technical requirements of power transformer

1	Rated MVA of Transformer (ONAN rating) (Minimum)	**8.00MVA**
2	No. of Phases	3
3	Type of Installation	Outdoor
4	Frequency	50 Hz (± 5%)
5	Cooling medium	Insulating Oil (ONAN)
6	Type of mounting	On Wheels, Mounted on rails.
7	Rated voltage	
	a) High Voltage Winding	33 kV ± 6%
	b) Low Voltage Winding	11 kV ± 6%
8	Highest continuous system Voltage	
	a) Maximum system Voltage ratio (HV / LV)	36 kV/ 12 kV
	b) Rated Voltage ratio (HV / LV)	33 kV/ 11 kV
9	No. of windings	Two winding Transformers (minimum)
10	Type of cooling	ONAN (Oil natural & Air natural)
11	MVA Rating corresponding to ONAN cooling system	100%
12	Method of connection:	
	HV:	Delta
	LV:	Star
13	Connection symbol	Dyn 11
14	System earthing	Neutral of LV side to be solidly earthed.
15	Percentage impedance voltage on Normal tap and MVA base at 750C corresponding to HV/ LV rating and applicable tolerances :	% Impedance 8MVA - 8.35% (Tolerance +10%) (No negative tolerance will be allowed)
16	Intended regular cyclic overloading of windings	As per IEC –76-1, Clause 4.2
17	a) Anticipated unbalanced loading	Around 10%
	b) Anticipated continuous loading of windings (HV / LV)	110 % of rated current
18	Type of tap changer	On-Load In-tank Type tap changer hanger for 8 MVA
	Range of taping	+ 5% to – 15% in 9 equal steps of 2.5% each on HV winding
19	Neutral terminal to be brought out	On LV side only
20	Over Voltage operating capability and duration	112.5 % of rated voltage (continuous)
21	Maximum Flux Density in any part of	**1.5 Tesla**

	the core and yoke at rated MVA, rated voltage i.e 33kV / 11kV and system frequency of 50 Hz		
22	Insulation levels for windings :-	**33 kV**	**11 kV**
	a) 1.2 / 50 microsecond wave shape Impulse withstand (KVP)	170 (Minimum)	95 (Minimum)
	b) Power frequency voltage withstand (KVrms)	70 (Minimum)	28 (Minimum)
23	Type of winding insulation		
	a) HV winding	Uniform	
	b) LV winding	Uniform	
24	Withstand time for three phase short circuit	2 Seconds (Minimum)	
25	Noise level at rated voltage and frequency	As per NEMA Publication No. TR-1.	
26	Permissible Maximum Temperature Rise over ambient temperature of 500 C		
	a) Of top oil measured by thermometer.	350 C	
	b) Of winding measured by resistance.	400 C	
	c)Hot Spot Temperature rise	540 C	
27	Minimum clearances in air (mm) :-	Phase to Phase	Phase to ground
	a) HV	400	320
	b) LV	280	140
28	Terminals :-		
	a) HV winding line end	36kV oil filled communicating type porcelain bushings (Anti fog type)	
	b) LV winding	12kV porcelain type of bushings (Antifog type) (Minimum)	
29	Insulation level of Bushing :-	HV	LV
	a) Lightning Impulse withstand (KVP)	170	95
	b) 1 Minute Power Frequency withstand voltage (KV-rms)	70	28
	c) Creepage distance (mm) (minimum)	900	300
30	Material of HV & LV Conductor	Electrolytic Copper	
31	Maximum current density for HV and LV winding for rated current at normal tap	2.4 A/ mm2	
32	Polarisation Index i.e. ratio of Megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV	Shall be greater than or equal to 1.5, but less than or equal to ‘5’.	
33	Core Assembly	Boltless type	
34	Temperature Indicator		
	a) Oil	One number	

	b) Winding	One number
35	Maximum permissible no load loss at rated voltage and rated frequency.	4.5KW (Maximum)
36	Maximum permissible load loss at rated current, at normal tap and at 750 C	38.0KW (Maximum)
37	Paper Covering thickness of HV Winding Conductor	0.6 mm (minimum)
38	Paper Covering thickness of LV Winding Conductor	0.5 mm (minimum)
39	Clearances:-	
	a) Gap between HV Coil to the inside of the tank on the longer side	65 mm (minimum)
	b) Gap between HV Coil to the inside of the tank on the width side (LV Side)	65 mm (minimum)
	c) Gap between HV Coil to the inside of the tank on the width side (HV Side to accommodate delta and tapping leads)	115 mm (minimum)
	d) Gap between Core yoke to tank bottom	55 mm (minimum)
	e) Yoke insulation at top and bottom	130 mm (minimum)
	f) Phase to Phase clearance between HV Limbs	20 mm (minimum)
	g) Radial Clearance between LV and HV Coil	20 mm (minimum)
	h) Radial Clearance between Core to LV Coil	12.5 mm (minimum)
40	The difference of Ampere Turns at each location shall not be more than 5 % at all percentages of tappings	
41	Winding to winding clearance should have minimum 20% of sum of pressboard Cylinder/Barrier.	
42	Tap changing gear:	
	(i)Type	In Tank, High Speed Resistor Type
	(ii)Provided on	HV Side
	(iii) Tap range	15% to +5%
	(iv) Tap Step	2.5% of 33kV
	(v) Minimum Rated current	200[a]
	(vi) Minimum Rated short circuit current	3KA
	(vii) Automatic control required	YES
	(viii) Remote Control Panel required	YES
	(ix) Marshalling kiosk required	YES
43.	Minimum Air core reactance of HV winding	20%
44.	Type of oil preservation	Air-cell type

2.1. Marshalling box

A metal enclosed, weather, vermin and dust proof marshalling box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch etc. shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. It shall have degree of protection of IP 55 or better as per relevant standards.

2.2. Performance

i) Transformer shall be capable of withstanding for two seconds without damage to any external short circuit.
ii) The maximum flux density in any part of the core and yoke at rated MVA, Voltage and frequency, shall be 1.5 Tesla (maximum).
iii) Transformer shall under exceptional circumstances due to sudden disconnection of the load, be capable of operating at the voltage approximately 25% above normal rated voltage for a period of not exceeding one minute and 40% above normal for a period of 5 seconds.
iv) The transformer may be operated continuously without danger on any particular tapping at the rated MVA ± 12.5% of the voltage corresponding to the tapping.
v) The thermal ability to withstand short circuit shall be demonstrated by calculation.
vi) Transformer shall be capable of withstanding thermal and mechanical stress caused by any symmetrical and asymmetrical faults on any winding. The Bidder shall submit the necessary Short Circuit Force Calculation with the offer.

2.3. Drawings / documents incorporating the following particulars shall be submitted with the bid

a) General outline drawing showing shipping dimensions and overall dimensions, net weights and shipping weights, quality of insulating oil, spacing of wheels in either direction of motion, location of coolers, marshalling box and tap changers etc.
b) Assembly drawings of core, windings etc. and weights of main components / parts.
c) Height of center line on HV and LV connectors of transformers from the rail top level.
d) Dimensions of the largest part to be transported.
e) GA drawings / details of various types of bushing
f) Tap changing and Name Plate diagram
g) Type test certificates of the quoted rating transformer.
h) Illustrative & descriptive literature of the Transformer.
i) The drawings and Type Test certificates of On-Load Tap Changer
j) Maintenance and Operating Instructions.
k) The Type Test certificates in complete shape for ‘Lightning Impulse’ and ‘Short Circuit’ Test and Temperature Rise Test

2.4. Miscellaneous

i) Padlocks along with duplicate keys as asked for various valves, marshalling box etc. shall be supplied by the contractor, wherever locking arrangement is provided.

ii) ii) Foundation bolts for wheel locking devices of Transformer shall be supplied by the Contractor.

2.5. Delivery

The full quantity of the equipments shall be delivered as per the delivery schedule appended to this specification.

2.6. Schedules

Any Schedule, if any, annexed to the specification shall be duly filled by the bidder separately.

2.7. Name plate

Transformer rating plate shall contain the information as per relevant standards.

The details on rating plate shall be finalized during the detailed engineering. Further, each transformer shall have inscription of client's name which will be intimated in later stage.

The name plate shall also include:

(i) The short circuit rating
(ii) Measured no load current and no load losses at rated voltage and rated frequency
(iii) Measured load losses at 750 C (Normal Tap only)
(iv) D.C resistance of each winding at 750 C.

3. System conditions

The equipment shall be suitable for installation in supply systems of the following characteristics.

Sl. No	Description	33 kV	11 kV
1	Frequency	50 Hz ± 5%	50 Hz ± 5%
2	Nominal system voltages	33 kV	11 kV
3	Maximum system voltages	36.3 kV	12 kV
4	Nominal short circuit level	As per relevant standards	
5	Insulation levels (1.2/50 µ sec impulse withstand voltage)	170 kV (peak) (Minimum)	95kV (peak) (Minimum)
6	Power frequency with one minute withstand (wet & dry) voltage	70 kV(rms) (Minimum)	28 kV(rms) (Minimum)
7	Neutral earthing arrangements	-	Solidly earthed

4. Codes & standards

4.1. The design, material, fabrication, manufacture, inspection, testing before dispatch and performance of power transformers at site shall comply with all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The

equipment shall also conform to the latest applicable standards and codes of practice. Nothing in this specification shall be construed to relieve the Contractor of this responsibility.

The equipment complying other internationally accepted standards, may also be considered if they ensure performance superior to the Indian Standards.

4.2. Drawings

a) The contractor shall furnish, within fifteen days after issuing of Letter of Award. Six copies each of the following drawings/documents incorporating the transformer rating for approval.

i) Detailed overall general arrangement drawing showing front and side elevations and plan of the transformer and all accessories including radiators and external features with details of dimensions, spacing of wheels in either direction of motion, net weights and shipping weights, crane lift for un-tanking, size of lugs and eyes, bushing lifting dimensions, clearances between HV and L.V terminals and ground, quantity of insulating oil etc.

ii) Assembly drawings of core and winging and weights of main components / parts. In the Core-Coil assembly drawing, the following dimensions should be clearly mentioned:

Core:- Window Height, Leg Centre, Core diameter, Grade & thickness of Core material, gross & net Core Cross-Sectional area, Watt loss per kg at the quoted flux density, VA per kg at the quoted flux density.

HV & LV Windings: - Conductor Size (both bare and insulated), Inside and Outside diameters, axial heights, type of windings, No. of spacers with sizes, No. of discs, No. of turns/disc, gap between discs ,clearance from top and bottom yoke, gap between windings, Size of the conductor for delta connection etc.

iii) Foundation plan showing loading on each wheel land jacking points with respect to Centre line of transformer.

iv) GA drawings details of bushing and terminal connectors.

v) Name plate drawing with terminal marking and connection diagrams.

vi) Wheel locking arrangement drawing.

vii) Transportation dimensions drawings.

viii) Magnetization characteristic curves of PS class neutral and phase side current transformers, if applicable.

ix) Interconnection diagrams.

x) Over fluxing withstand time characteristic of transformer.

xi) GA drawing of marshalling box.

xii) Control scheme/wiring diagram of marshalling box.

xiii) Technical leaflets of major components and fittings.

xiv) As built drawings of schematics, wiring diagram etc.
xv) Setting of oil temperature indicator, winding temperature indicator.

xvi) Completed technical data sheets.

xvii) Detail Drawings, Type Test Certificates including write-up of On- Load tap changing gear and its required accessories/equipments, wiring diagrams etc. as per this specification.

xviii) HV conductor bushing.

xix) Bushing Assembly.

xx) Bi-metallic connector suitable for connection to 100 sq. mm up to 232 Sq.mm AAAC Conductor.

xxi) GA of LV cable Box.

xxii) Radiator type assembly

xxiii) Specific loss(watt/Kg. vs. Flux density),VA/Kg .vs. Flux density &B-H Graph for the offered HIB or better core material, to be used for the offered transformer

b) All drawings, documents, technical data sheets and test certificates, results and calculations shall be furnished.

c) Ampere –Turns Calculation at various locations and tapping positions of both LV and HV windings.

4.3. Any approval given to the detailed drawings by the CLIENT shall not relieve the contractor of the responsibility for correctness of the drawing and in the manufacture of the equipment. The approval given by the CLIENT shall be general with overall responsibility with contractor.

5. General constructional features

5.1. All material used shall be of best quality and of the class most suitable for working under the conditions the various parts for the work which they have to perform.

5.2. Similar parts particularly removable ones shall be interchangeable.

5.3. Pipes and pipe fittings, screws, studs, nuts and bolts used for external Connections shall be as per the relevant standards. Steel bolts and nuts exposed to atmosphere shall be galvanized.

5.4. Nuts, bolts and pins used inside the transformers and tap changer compartments shall be provided with lock washer or locknuts.

5.5. Exposed parts shall not have pockets where water can collect.

5.6. Internal design of transformer shall ensure that air is not trapped in any location.

5.7. Material in contact with oil shall be such as not to contribute to the formation of acid in oil. Surface in contact with oil shall not be galvanized or cadmium plated.

5.8. Labels, indelibly marked, shall be provided for all identifiable accessories like Relays, switches current transformers etc. All label plates shall be of in corrodible material.

5.9. All internal connections and fastenings shall be capable of operating under overloads and over-excitation, allowed as per specified stands without injury.

5.10. Transformer and accessories shall be designed to facilitate proper operation, inspection, maintenance and repairs.

5.11. No patching, plugging, shimming or other such means of overcoming defects, discrepancies or errors will be accepted.

5.12. Schematic Drawing of the wiring, including external cables shall be put under the propane sheet on the inside door of the transformer marshalling box.

5.13. Painting

5.13.1. **Particular attention shall be paid to the following:**

a) Proper storage to avoid exposure as well as extremes of temperature.
b) Surface preparation prior to painting.
c) Mixing and thinning
d) Application of paints and the recommended limit on time intervals between coats.
e) Shelf life for storage.

5.13.1.1. All paints, when applied in normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

5.13.1.2. All primers shall be well marked into the surface, particularly in areas where painting is evident, and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to the manufacturer's recommendations. However, wherever airless spray is not possible, conventional spray be used with prior approval of Client.

5.13.1.3. The supplier shall, prior to painting protect nameplates, lettering gauges, sight glasses, light fittings and similar such items.

5.13.2. **Cleaning and Surface Preparation**

5.13.2.1. After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.

5.13.2.2. Steel surfaces shall be prepared by Sand/Shot blast cleaning and Chemical cleaning by Seven tank process including Phosphating to the appropriate quality. The surface shall be treated by phosphating and dried in accordance with relevant standards (Code of practices for phosphating of Iron and Steel). Immediately after Phosphating, surface shall be given two coats of high quality Zinc Chromate Primer.

5.13.2.3. The pressure and Volume of the compressed air supply for the blast cleaning shall meet the work requirements and shall be sufficiently free from all water contamination prior to any painting.

5.13.2.4. Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale and shall only be used where blast cleaning is impractical.

5.13.3. **Protective Coating**

As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anticorrosion protection.

5.13.4. **Paint Material**

Followings are the type of paints that may be suitably used for the items to be painted at shop and supply of matching paint to site:

i) Heat resistant paint (Hot oil proof) for inside surface.
ii) For external surfaces one coat of Thermo Setting Paint or 2 coats of Zinc chromate followed by 2 coats of POLYURETHANE. The colour of the finishing coats shall be dark admiral grey conforming to No.632

5.13.5. **Painting Procedure**

5.13.5.1. Al painting shall be carried out in conformity with both specifications and with the paint manufacture's recommendations. All paints in any one particular system. Whether shop or site applied, shall originate from one paint manufacturer.

5.13.5.2. Particular attention shall be paid to the manufacture's instructions on storage, mixing, thinning and pot life. The paint shall only be applied in the manner detailed by the manufacturer e.g. brush, roller, conventional or airless spray and shall be applied under the manufacturer's recommended conditions. Minimum and maximum time intervals between coats shall be closely followed.

5.13.5.3. All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is warm.

5.13.5.4. Where the quality of film is impaired by excess film thickness,(wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coatings and apply another. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25% . In all instances, where two or more coats of the same paints are specifies, such coatings may or may not be of contrasting colours.

5.13.5.5. Paint applied to items that are not be painted, shall be removed at supplier's expense, leaving the surface clean, un-stained and undamaged.

5.13.6. **Damages to Paints Work**

5.13.6.1. Any damage occurring to any part of the painting scheme shall be made good to the same standard of corrosion protection and appearance as that originally employed.

5.13.6.2. Any damaged paint work shall be made as follows:

a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
b) A priming coat shall immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the originally damaged.

5.13.6.3. The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before & after priming.

5.13.7. **Dry Film Thickness**

5.13.7.1. To the maximum extent practicable, the coats shall be applied as a continuous film of uniform thickness and free of pores. Over-spray, skips, runs, sags and drips should be avoided. The different coats may or may not be same colour.

5.13.7.2. Each coat of paint shall allowed to hardened before the next is applied as per manufacture's recommendations.

5.13.7.3. Particular attention must be paid to full film thickness at edges.

5.13.7.4. The requirement for the dry film thickness (DFT) of paint and the material to be used shall be as given below:

Sl. No	Paint Type	Area to be painted	No of Coats	Total Dry film thickness(Min)
1.	Liquid Paint			
	a) Zinc Chromate (Primer)	Out side	02	45 micron
	b) Polyurethane (Finish Coat)	Out side	02	35 micron
	c) Hot Oil	inside	01	35 micron

6. Detailed description

6.1. Tank

6.1.1. The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank shall be of welded construction. The transformer Tank shall be of rectangular Shape design (No elliptical shape design is allowed).

6.1.2. Tank shall be designed to permit lifting by crane or jacks of the complete transformer assembly filed with oil. Suitable lugs and bossed shall be provided for this purpose.

6.1.3. All beams, flanges, lifting lugs, braces and permanent parts attached to the tank shall be welded and where practicable, they shall be double welded.

6.1.4. The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg. **The side Tank wall shall be of 8mm (minimum). The bottom and Top Plate of the Tank shall be 12mm.(minimum).**

6.1.5. Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

6.1.6. Gaskets of nitrile rubber or equivalent shall be used to ensure perfect oil tightness. All gaskets shall equivalent sections on bolt sides of the gasket, throughout their total length. Care shall be taken to secure uniformly distributed mechanical strength over the gaskets and retains throughout the total length. Gaskets of neoprene and / or any kind of impregnated / bonded core or cork only which can easily be damaged by over-pressing are not acceptable. Use of hemp as gasket material is also not acceptable.

6.1.7. Suitable guides shall be provided for positioning the various parts during assemble or dismantling. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.

6.2. Tank Cover

The transformer top shall be provided with a detachable tank cover with bolted flanged gasket joint. Lifting lugs shall be provided for removing the cover. The surface of the cover shall be suitable sloped so that it does not retain rain water.

6.3. Under carriage

6.3.1. The transformer tank shall be supported on steel structure with detachable plain rollers completely corrosion and shall be equipped with fittings for lubrication. It shall be possible to swivel the wheels in two directions, at right angle to or parallel to the main axis of the transformers.

6.4. CORE

6.4.1. Stage inspection for core construction shall be carried out by the Purchaser.

6.4.2. Each lamination shall be insulated such that it will not deteriorate due to mechanical pressure and the action of hot transformer oil.

6.4.3. The core shall be constructed from high grade, non-aging Cold Rolled Grain Oriented (CRGO) silicon steel laminations conforming to HIB grade or better grade with lamination thickness not more than 0.23mm to 0.27mm. The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall not be more than 1.5 Tesla. The Bidder shall provide saturation curve of the core material, proposed to be used. Laminations of different grade(s) and different thickness (s) are not allowed to be used in any manner or under any circumstances.

6.4.4. The bidder should offer the core for inspection starting from the destination port to enable client for deputing inspecting officers for detail verification as given below and approval by the CLIENT during the manufacturing stage. Bidder's call notice for the purpose should be accompanied with the following documents as applicable as a proof towards use of prime core material:

(A) The core coils, if found suitable, are to be sealed with proper seals which shall be opened in presence of the inspecting officers during core- cutting at the manufacturer's or it's sub-vendor's premises as per approved design drawing.

a) Purchase Order No. & Date.
b) Invoice of the supplier
c) Mills test certificate
d) Packing list
e) Bill of lading
f) Bill of entry certificate to customs

Core material shall be directly procured either from the manufacturer or through their accredited marketing organization of repute, but not through any agent.

(B) For Transformer Manufacturer (TM), who has in-house core-cutting facility, the packed core coils

i) Purchase Order No. & Date ;
ii) No. of packed coils with Package Nos.
iii) Gross Weight.
iv) Net Weight :
v) Port of loading.
vi) Port of Discharge ;
vii) Name of the Ocean Vessel :
viii) Grade & Thickness of Core Material :
ix) Any other information as mentioned on the body of packed coils.

(C) For those bidders, who have no in-house core-cutting facility, they should mention the names of at least three sub-vendors to whom they intend to assign their core-cutting. Such sub-vendors should have been approved by other Electricity Board / Electrical Utilities and accredited by some internationally recognized certification body like ISO-9000 etc. to ensure that a minimum quality parameters & tolerance are maintained. The experience, the details of core-cutting facilities finishing & testing facilities etc. as available which such sub-vendors should be clearly out-lined in the bid

(D) On award of Contract the TM is to assign the core-cutting to such sub vendors for which approval is to be given by the CLIENT.

6.4.5. The laminations shall be free of all burrs and sharp projections. Each sheet shall have an insulting coating resistant to the action of hot oil.

6.4.6. The insulation structure for the core to bolts and core to clamp plates, shall be such as to withstand 2000 V DC voltage for one minute.

6.4.7. The completed core and coil shall be so assembled that the axis and the plane of the outer surface of the core assemble shall not deviate from the vertical plane by more than 25mm.

6.4.8. All steel sections used for supporting the core shall be thoroughly shot or sand blasted, after cutting, drilling and welding.

6.4.9. The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.

6.4.10. The core clamping structure shall be designed to minimize eddy current loss.

6.4.11. The framework and clamping arrangements shall be securely earthed.

6.4.12. The core shall be carefully assembled and rigidly clamped to ensure adequate mechanical strength.

6.4.13. Oil ducts shall be provided, where necessary, to ensure adequate cooling inside the core. The welding structure and major insulation shall not obstruct the free flow of oil through such ducts.

6.4.14. The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earth clamping structure and production of flux component at right angle to the plane of the lamination, which may cause local heating. The supporting framework of the cores shall be so designed as to avoid the presence of pockets, which would prevent complete emptying of the tank through the drain valve or cause trapping of air during filling.

6.4.15. The construction is to be of boltless core type. The core shall be provided with lugs suitable for lifting the complete core and coil assembly. The core and coil assemble shall be so fixed in the tank that shifting will not occur during transport or short circuits.

6.4.16. The temperature gradient between core & surrounding oil shall be maintained less than 20 deg. Centigrade. The manufacturer shall demonstrate this either through test (procedure to be mutually agreed) or by calculation.

6.5. INTERNAL EARTHING

6.5.1. All internal metal parts of the transformer, with the exception of individual laminations and their individual clamping plates shall be earthed.

6.5.2. The top clamping structure shall be connected to the tank by a copper strap. The bottom clamping structure shall be earthed by one or more the following methods:

a) By connection through vertical tie-rods to the top structure.
b) By direct metal to metal contact with the tank base.
c) By a connection to the structure on the same side of the core as the main earth connection to the tank.

6.5.3. The magnetic circuit shall be connected to the clamping structure at one point only and this shall be brought out of the top cover of the transformer tank through a suitably rated insulator. A disconnecting link shall be provided on transformer tank to facilitate disconnections from ground for IR measurement purpose.

6.5.4. Coil clamping rings of metal at earth potential shall be connected to the adjacent core clamping structure on the same side as the main earth connections.

6.6. Winding

6.6.1. Winding shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.

6.6.2. All low voltage windings for use in the circular coil concentric winding shall be wound on a performed insulating cylinder for mechanical protection of the winding in handling and placing around the core.

6.6.3. Winding shall not contain sharp bends which might damage the insulation or produce high dielectric stresses. No strip conductor wound on edge shall have width exceeding six times the thickness.

6.6.4. 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 the otherwise affected under the operating conditions.

6.6.5. Varnish application on coil windings may be given only for mechanical protection and not for improvement in dielectric properties. In no case varnish or other adhesive be used which will seal the coil and prevent evacuation of air and moisture and impregnation by oil.

6.6.6. Winding and connections shall be braced to withstand shocks during transport or short circuit.

6.6.7. Permanent current carrying joints in the windings and leads shall be welded or brazed. Clamping bolts for current carrying parts inside oil shall be made of oil resistant material which shall not be affected by acidity in the oil steel bolts, if used, shall be suitably treated.

6.6.8. Terminals of all windings shall be brought out of the tank through bushings for external connections.

6.6.8.1. The completed core and coil assemble shall be dried in vacuum at not more than 0.5mm of mercury vacuum over or in the transformer tank.

6.6.8.2. The winding shall be so designed that all coil assembles of identical voltage ratings shall be interchangeable

6.6.8.3. Coils shall be made of continuous smooth high grade electrolytic copper conductor, shaped and braced

6.6.8.4. Adequate barriers shall be provided between coils and core and between high and low voltage coil.

6.6.8.5. The insulation of winding shall be designed to withstand voltage stress arising from surge in transmission

6.6.8.6. Tapping shall not be brought out from inside the coil or from intermediate turns and shall be so arranged

6.6.8.7. Magnitude of impulse surges transferred from HV to LV windings by electromagnetic induction and

6.6.8.8. The current density adopted in all winding shall not exceed 2.4 A/mm^2. The total net conductor area

0.21 mm^2	up to a depth of 1.6 mm
0.36 mm^2	mm up to a depth of 2.24 mm
0.55 mm^2	up to a depth of 3.25 mm
0.86 mm^2	above 3.25 mm

6.6.8.9. The finally compressed shrunk height of both HV and LV windings should be equal.

6.7. Insulating oil

6.7.1. The insulating oil for the transformer shall be of EHV grade, generally conforming to relevant standards. No inhibitors shall be used in the oil.

6.7.2. The quantity of oil required for the first filling of the transformer and its full specification shall be stated in the bid. The bidder shall quote the price of transformer complete with all fittings, accessories and new transformer oil required for first filling plus 10% extra oil. The extra quantity of oil shall be supplied in non-returnable drums along with the oil required for the radiator banks.

6.7.3. The design and materials used in the construction of the transformer shall be such as to reduce the risk of the development of acidity in the oil.

6.7.4. Transformer Oil-The contractor shall ensure that the Transformer oil furnished conforms to relevant standards.

6.8. Valves

i) **Valves shall be of forged carbon steel up to 50mm size and of gun mental or of cast iron bodies** with gun metal fittings for sizes above 50mm.

They shall be of full way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.

ii) Each valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection. Padlocks with duplicate keys shall be supplied along with the valves.

iii) All valves except screwed valves shall be provided with flanges having machined faced drilled to suit the applicable requirements, Oil tight blanking plates shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required the contractor shall supply the same.

iv) Each transformer shall be provided with following valves on the tank:

a) Drain valve so located as to completely drain the tank & to be provided with locking arrangement.
b) Two filter valves on diagonally opposite corners of 50mm size & to be provided with locking arrangement.
c) Oil sampling valves not less than 8mm at top and bottom of main tank & to be provided with locking arrangement.
d) One 15mm air release plug.
e) Valves between radiators and tank.
f) Drain and filter valves shall be suitable for applying vacuum as specified in this specification.

6.9. Accessories

6.9.1. Bushing

i) All porcelain used in bushings shall be homogeneous, non-porous, uniformly glazed to brown colour and free from blisters, burns and other defects.
ii) Stress due to expansion and contraction in any part of the bushing shall not lead to deterioration.
iii) Bushing shall be designed and tested to comply with the applicable standards.
iv) Bushing rated for 400A and above shall have non-ferrous flanges and hardware.
v) Fittings made of steel or malleable iron shall be galvanized
vi) Bushing shall be so located on the transformers that full flashover strength will be utilized. Minimum clearances as required for the BIL shall be realized between live parts and live parts to earthed structures.
vii) All applicable routine and type tests certificates of the bushings shall be furnished for approval.
viii) Bushing shall be supplied with bi-metallic terminal connector/ clamp/ washers suitable for fixing to bush terminal and the CLIENT's specified conductors. The connector/clamp shall be rated to carry the bushing rated current without exceeding a temperature rise of 500 C over an ambient of 500C. The connector/clamp shall be designed to be corona free at the maximum rated line to ground voltage.
ix) Bushing of identical voltage rating shall be interchangeable.

x) The insulation class of high voltage neutral bushing shall be properly coordinated with the insulation class of the neutral of the low voltage winding.
xi) Each bushing shall be so coordinated with the transformer insulation that all flashover will occur outside the tank.

6.9.2. **Protection & measuring devices**

i) **Oil conservator tank**

a) A conservator, complete with drain valve shall be provided in such a position, so as not to obstruct the electrical connections to the Transformer.

The capacity of the conservator between highest and lowest visible levels shall be minimum of 7.5% of the total cold oil volume in the Transformer.

b) The conservator tank shall be bolted on its support of mounting to allow for its removal for cleaning/ repairing purposes.
c) The conservator shall be fitted with magnetic oil level gauge with low level electrically insulated alarm contact.
d) The silica gel breather shall have minimum quantity of silica gel as1kg for every 3500Ltrs. of oil in the Tank. The container for the dehydring agent shall be of transparent plastic of best quality, to be approved by CLIENT.

ii) **Pressure Relief Device**

The pressure relief device provided shall be of sufficient size for rapid release of any pressure that may be generated in the tank and which may result in damage of the equipment. The device shall operate at a static pressure of less than the hydraulic test pressure of transformer tank. It shall be mounted direct on the tank. A pair of electrically insulated contract shall be provided for alarm and tripping.

iii) **Buchholz Relay**

A double float type Buchholz relay shall be provided. Any gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation. A copper tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent potential free contracts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

iv) **Temperature Indicator**

a) **Oil Temperature Indicator (OTI)**

The transformers shall be provided with a mercury contact type thermometer with 150 mm dial for top oil temperature indication. The

thermometer shall have adjustable, electrically independent potential free alarm and trip contacts. Maximum reading pointer and resetting device shall be mounted in the local control panel. A temperature sensing element suitably located in a pocket on top oil shall be furnished. This shall be connected to the OTI by means of capillary tubing. Accuracy class of OTI shall be ± 1% or better. One No electrical contact capable of operating at 5 A ac at 230 volt supply.

b) **Winding Temperature indicator(WTI)**

A device for measuring the hot spot temperature of the winding shall be provided. It shall comprise the following.

i) Temperature sensing element.
ii) Image Coil.
iii) Mercury contacts.
iv) Auxiliary CTS, If required to match the image coil, shall be furnished and mounted in the local control panel.
v) 150mm dial local indicating instrument with maximum reading pointer mounted in local panel and with adjustable electrically independent ungrounded contacts, besides that required for control of cooling equipment, one for high winding temperature alarm and on for trip.
vi) Calibration device.
vii) Two number electrical contact each capable of operating at 5 A ac at 230 Volt supply.

6.9.3. **Oil Preservation Equipment**

6.9.3.1. The oil preservation shall be diaphragm type oil sealing in conservator to prevent oxidation and contamination of oil due to contact with atmospheric moisture.

6.9.3.2. The conservator shall be fitted with a dehydrating filter breather. It shall be so designed that.

i) Passage of air is through a dust filter & Silica gel.
ii) Silica gel is isolated from atmosphere by an oil seal.
iii) Moisture absorption indicated by a change in colour of the crystals of the silica gel can be easily observed from a distance.
iv) Breather is mounted not more than 1400 mm above rail top level.

6.10. Marshalling box

i) Sheet steel, weather, vermin and dust proof marshalling box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch, watertight hinged and padlocked door of a suitable construction shall be provided with each transformer to accommodate temperature indicators, terminal blocks etc. The box shall have slopping roof and the interior and exterior painting shall be in accordance with the specification. Padlock along with duplicate keys shall be supplied for marshalling box. The degree of protection shall be IP-55 or better.

ii) The schematic diagram of the circuitry inside the marshalling box be prepared and fixed inside the door under a suitable sheet.

iii) The marshalling box shall accommodate the following equipment:

a) Temperature indicators.
b) Space for accommodating Control & Protection equipment in future for the cooling fan (for ONAF type cooling, may be provided in future).
c) Terminal blocks and gland plates for incoming and outgoing cables.

All the above equipments except c) shall be mounted on panels and back of panel wiring shall be used for inter-connection. The temperature indicators shall be so mounted that the dials are not more than 1600 mm from the ground level and the door (s) of the compartment(s) shall be provided with glazed window of adequate size. The transformer shall be erected on a plinth which shall be 2.5 feet above ground level.

iv) To prevent internal condensation, a metal clad heater with thermostat shall be provided. The heater shall be controlled by a MCB of suitable rating mounted in the box. The ventilation louvers, suitably padded with felt, shall also be provided. The louvers shall be provided with suitable felt pads to prevent ingress of dust.

v) All incoming cables shall enter the kiosk from the bottom and the gland plate shall not be less than 450 mm from the base of the box. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture from the cable trench.

vi) The control connection, wiring etc. shall be as per approved drawings

6.11. TAPCHANGER

6.11.1. **On-load tap-changers with remote tap change control**

Each transformer shall be provided with an “In-Tank” Type on-load tap-changer connected to the high voltage winding. The on-load tap-changer shall be capable of withstanding the voltages described earlier and shall comply with the requirements of IEC-60214, latest revision. Its tapping range, number of steps and tap positions shall be as specified.

On Load Tap Changer shall be sourced from reputed manufacturer(s) and it should be type tested as per relevant IEC60214 as given below and test methods shall be in full conformance to the procedures indicated in IEC: 60214

Sl. no	IEC Reference	Test descriptions
1	Cl.5.2.1	Temperature rise of contacts.
2	Cl.5.2.2	Switching Tests
3	Cl.5.2.3.	Short-circuit current Test.
4	Cl.5.2.4	Short-circuit current Test.

Sl. no	IEC Reference	Test descriptions
5	Cl.5.2.5	Mechanical tests.
6	Cl.5.2.6	Dielectric Tests

OLTC manufacturer shall conduct the following routine tests fully in compliance with IEC 60214 on every unit, as given below, before dispatch to assure the quality of the OLTC. CLIENT at its sole discretion may test-witness and inspect the Tap-Changers at the works of the OLTC manufacturer.

The following are the routine tests, to be carried out on each OLTC:-

Sl. no	IEC Reference	Test descriptions
1	Cl.5.3.1	Mechanical Test.
2	Cl.5.3.2	Sequence test
3	Cl.5.3.3	Auxiliary circuits Insulation tests
4	Cl.5.3.4	Pressure test
5	Cl.5.3.4	Vacuum test

All the test reports shall be submitted to CLIENT for approval. Adequate access for personnel shall be provided for inspection and maintenance. The guaranteed interval between maintenance periods for the diverter switch shall be 10 years or 50,000 operations. It shall not be possible for oil in the diverter switch compartment to come in contact with the oil in the main transformer tank.

The tap-changer shall be driven by a motor operated mechanism incorporating a stored energy device which shall ensure that once a change of tap begins it is completed and so shall ensure that the mechanism does not fail in an intermediate position on loss of the supply voltage to the motor. The motor shall be rated for 400/230V, 50 Hz and shall operate satisfactorily at any voltage between 85% and 110% of rated voltage.

A tap-changer mechanism box with hinged door and mounted on the transformer tank at a convenient height shall contain all electrical and mechanical parts associated locally with control of the tap-changer. Remote tap-changer controls shall also be provided at a transformer control panel (one per transformer, to be supplied under this contract) in the control room.

Facilities for electrical raise and lower operation (Control switch or push button) as well as mechanical operation shall be provided as the tap-change mechanism box. An interlock shall be provided which shall interrupt the electric supply to the drive motor when the manual mechanical operating device is engaged. The motor drive control shall be such that on initiation of a tap change operation by means of a control switch or push-button the tap-changer shall complete its movement form one service position to an adjacent one irrespective of whether or not the control switch or push button has been operated continuously during the running time or motor drive. Another operation shall only be possible when the previous operation has

been completed, the control switch or push button has been released and the control system is again in the rest position.

The tap-changer arrangement shall be such that a command to raise tap numbers shall result in an increase in the secondary voltage with constant voltage applied to the high voltage winding.

An under and over voltage monitoring relay fed with line voltage from the owner's voltage transformers on the low voltage side of the transformer and capable of being set in a continuously variable range from 90% to 115% normal voltage (110V) shall be used to give visual and audible signals at the remote tap change control panel if the LV voltage lies above or below preset values.

Limit switches shall be provided to prevent over-running of the tap-change mechanism. These shall be directly connected in the motor circuit. In addition mechanical end stops shall be fitted to prevent over-running of the mechanism under any conditions. A counter shall be provided to indicate the number of tap change operations that have been taken place.

A mechanical tap-position indicator shall be provided and it shall be visible from ground level through a window in the door of the mechanism box. Position transmitter e.g. dial switches shall be provided to:

a. Signal tap position to the control cabinet in the control room.
b. Signal "out of step" under parallel operating conditions.

A Remote/Local switch shall be provided at the mechanism box to select either remote or local operation. When this switch is turned to the Remote position control shall be passed to the control cabinet in the control room. It should be possible to use only one control, i.e. Local or Remote.

It shall be possible to operate a transformer tap-changer independently or in parallel with the tap-changers of other similar transformers in the same substation in either a "master" or "follower" mode. In addition, when operating independently or in parallel in the master mode, it shall be possible to have manual operation by means of control switch, push button or, (in future) automatic operation by means of an automatic voltage regulating relay.

Contacts shall be provided for future SCADA control of the tap-changer and for reporting of the tap position and mode of control to the SCADA system. The paralleling scheme shall use the in- step principle and shall have provision for operating singly or in parallel in any combination. It shall be possible for any transformer in a group to be selected as either the master or follower for that group when operating in parallel. Each transformer control panel shall therefore have a manual/automatic control switch or push buttons, independent/master/follower control switch or push buttons as well as "raise" and lower" control switches or push buttons. Interlock shall be provided to avoid independent operation when the

transformers are running in parallel. There should not be any out-of-step during such operation.

The control scheme shall be capable of extension to cater for the total number of transformers to be installed in any future development of the substation. The control mode selected shall be indicated on the front of the control cabinet.

Each transformer shall have a miniature circuit breaker (MCB) on the AC distribution cabinet through which the 400/230V, 50 Hz supply to its tap changer and temperature controls is passed. Separate MCB's shall be provided at the mechanism box for protection of the motor and control circuits. The control circuits shall operate at 110V single phase, to be supplied from a transformer having a ratio of 230/55-0-55 V, with the center point earthed through a removable link mounted in the marshalling box or tap-changer mechanism box.

Each tap-changer mechanism box shall be fitted with an anti-condensation space heater (230V AC) controlled by a humidistat with variable range. A lamp for illumination purposes controlled by a door switch shall be provided. Solar gain can give rise to high temperature within a mechanism box. Adequate ventilation shall be provided to ensure that all equipment contained therein shall operate satisfactorily under these conditions.

A terminal block with terminals rated for 10 A continuous current, 650V grade of moulded insulating materials shall be provided for panel wiring and external connection.

Ten percent spare terminals shall be provided in each mechanism box.

The tap changer mechanism box shall be outdoor, weatherproof type, dust, vermin and damp proof with a degree of protection of IP54 of IEC 529.

6.11.2. **Transformer Tap Change Control Panel**

The indoor panel suitable for installation in the owner's control room mentioned above shall contain.

- Raise and Lower push buttons or switch.
- Independent / master / follower selector switch.
- Remote tap position indicator.
- Necessary audible & visual alarms.
- Out of step relay with two spare contacts (2 NO + 2 NC)

In addition to the above the Transformer tap change control panel shall have an audible and visual annunciation system for the following trips and alarms.

- Oil temperature alarm
- Oil temperature trip
- Winding temperature alarm

- Winding temperature trip
- Buchholz alarm
- Buchholz trip
- Surge relay trip (OLTC gear)
- Low oil level alarm
- Tap changer out-of-step alarm
- Failure of D.C supply alarm

Two spare windows shall be supplied on each panel Indicating lamps shall be panel mounted type with rear terminal connections.

Lamps shall be provided with series connected resistors preferably built within the lamp assembly. Lamps shall have screwed translucent lamp covers to diffuse light and shall be continuously rated for 120 percent of the 24 volt DC supply from a power pack having desired capacity. The 'DC supply failure' lamp shall operate from the AC supply and be rated for 230 Volt AC. The wattage of the lamps shall be not more than five watts. Bulbs and lenses shall be interchangeable and easily replaceable from the font of the panel.

The Annunciation scheme with facial windows and alarm bells shall work as follows.

Annunciation scheme functions

Incident Alarm Bell Facial Window

- Fault occurrence Ringing Light flashing
- Sound cancel Off Light flashing
- Acknowledge Off Steady light
- Fault cleared and reset Off Clear
- Lamp test Off Steady

Any new annunciation operating after the operation of the 'sound cancel' shall cause audible and visual alarm even if the process of acknowledging the previous alarm is going on or has yet to be carried out. Resetting facilities for the flasher and audible alarm circuits of the annunciator shall be provided, and provision shall be made for switching off the entire annunciation system. Two spare windows shall be provided.

The control and relay panel shall be metal clad, dust, moisture, rodent and vermin proof with degree of protection not less than IP 41 specified in IEC :529. Panels shall have folded construction and be of unit type. Each panel shall be a free standing structure, independent floor mounting type and shall be manufactured from cold rolled sheet steel of thickness not less than 2.5 mm. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transportation, installation and service. The panel shall be painted as specified in the clause on "painting" in the specification.

Design, material selection and workmanship shall be such as to result in neat appearance inside and outside with no welds, rivets or bolt ends apparent from

outside, with all exterior surfaces even and smooth. The equipment on the front of the panel shall be matched to give neat uniform appearance.

All doors and removable covers shall be gasket all round with neoprene bonded gaskets, Ventilating louvers shall be provided with screens and filters.

The screen shall be made of non-corroding metal like brass or galvanized iron wire mesh.

The transformer tap change control panel shall be supplied with all necessary internal wiring, terminal blocks, relays and alarms to provide the above listed alarm and trip functions.

Panel wiring shall be suitably bunched and clamped for neat appearance. The conductors used for wiring purpose shall be PVC insulated 650 Volt grade semi-flexible heat resistant, flame retardant and vermin proof electrolytic copper cable conforming to IEC: 227. The wiring shall be securely supported and taken through PVC troughs. All panel wiring shall be capable of withstanding a voltage of 2 KV AC 50 Hz for one minute.

Terminal blocks of brass studs rated for 10 amps continuous current, 650 volt DC grade covered by moulded insulating materials with adequate electrical clearance shall be provided for terminating the panel wiring and outgoing connections. The termination shall be made by crimping lugs or bare conductor with insulating sleeves at the ends. The arrangement can be horizontal or vertical as per standard practice adopted by the manufacturer. All terminals must be numbered and wire terminations provided with numbered ferrules for identification. All numbering and marking including those in wiring diagrams shall follow the guidelines provided in relevant standards. Ten percent spare terminals shall be provided.

A separate removable gland plate shall be provided at the bottom of each panel for entry of PVC insulated control and auxiliary power cables in the cabinet. At least five electroplated brass cable glands of approved sizes with shrouds shall be provided in the gland plate for these cables. Provision shall be made for earthing of the cable armours in the glands.

6.12. Control connections and instrument and wiring terminal board and fuses

i) Normally no fuses shall be used anywhere instead of fuses MCB's (both in AC & DC circuits) shall be used. Only in cases where a MCB cannot replace a fuse due to system requirements, a HRC fuse can be accepted.

ii) All wiring connections, terminal boards, fuses MCB's and links shall be suitable for tropical atmosphere. Any wiring liable to be in contact with oil shall have oil resisting insulation and the bare ends of stranded wire shall be sweated together to prevent seepage of oil along the wire.

iii) Panel connections shall be neatly and squarely fixed to the panel. All instruments and panel wiring shall be run in PVC or non-rusting metal cleats of the compression type. All wiring to a panel shall be taken from suitable terminal boards.

iv) Where conduits are used, the runs shall be laid with suitable falls, and the lowest parts of the run shall be external to the boxes. All conduit runs shall be adequately drained and ventilated. Conduits shall not be run at or below ground level.

v) When 400 volt connections are taken through junction boxes or marshalling boxes, they shall be adequately screened and 400 volts Danger Notice must be affixed to the outside of the junction boxes or marshalling box. Proper colour code for Red, Yellow, Blue wires shall be followed.

vi) All box wiring shall be in accordance with relevant standards . All wiring shall be of stranded copper (48 strands) of 1100 Volt grade and size not less than 2.5 sq.mm

vii) All wires on panels and all multi-core cables shall have ferrules, for easy identifications, which bear the same number at both ends, as indicated in the relevant drawing.

viii) At those points of interconnection between the wiring carried out by separate contractors, where a change of number cannot be avoided double ferrules shall be provided on each wire. The change of numbering shall be shown on the appropriate diagram of the equipment.

ix) The same ferrule number shall not be used on wires in different circuits on the same panels.

x) Ferrules shall be of white insulating material and shall be provided with glossy finish to prevent the adhesion of dirt. They shall be clearly and durably marked in black and shall not be affected by dampness or oil.

xi) Stranded wires shall be terminated with tinned Ross Courtney terminals, claw washers or crimped tubular lugs. Separate washers shall be suited to the size of the wire terminated. Wiring shall, in general, be accommodated on the sides of the box and the wires for each circuit shall be separately grouped. Back of panel wiring shall be arranged so that access to the connecting items of relays and other apparatus is not impeded.

xii) All circuits, in which the voltage exceeds 125 volts, shall be kept physically separated from the remaining wiring. The function of each circuit shall be marked on the associated terminal boards.

xiii) Where apparatus is mounted on panels, all metal cases shall be separately earthed by means of stranded (48 No.) copper wire of strip having a cross section of not less than 2.5 sq. mm where strip is used, the joints shall be sweated. The copper wire shall have green colour insulation for earth connections.

xiv) All wiring diagram for control and relay panel shall preferably be drawn as viewed from the back and shall show the terminal boards arranged as in services.

xv) Terminal block rows should be spaced adequately not less than 100 mm apart to permit convenient access to external cables and terminations.

xvi) Terminal blocks shall be placed with respect to the cable gland (at a minimum distance of 200 mm) as to permit satisfactory arrangement of multi core cable tails .

xvii) Terminal blocks shall have pairs of terminals for incoming and outgoing wires. Insulating barriers shall be provided between adjacent connections. The height of the barriers and the spacing between terminals shall be such as to give adequate protection while allowing easy access to terminals. The terminals shall be adequately protected with insulating dust proof covers. No live metal shall be exposed at the back of the terminal boards. CT terminals shall have shorting facilities. The terminals for CTs should have provision to insert banana plugs and with isolating links.

xviii) All interconnecting wiring, as per the final approved scheme between accessories of transformer and marshalling box is included in the scope of this specification and shall be done by the Transformer supplier.

xix) The schematic diagram shall be drawn and fixed under a transparent propane sheet on the inner side of the marshalling box cover.

xx) To avoid condensation in the Marshalling Box, a space heater shall be provided with an MCB and thermostat.

xxi) Suitable MV, CFL light shall be provided in the Marshalling Box for lightning purpose.

6.13. Radio interference and noise level

Transformers shall be designed with particular care to suppress at least the third and fifth harmonic voltages so as to minimize interference with communication circuits. Transformer noise level when energized at normal voltage and frequency shall be as per NEMA stipulations.

7. Inspection and testing

(i) The Contractor shall carry out a comprehensive inspection and testing program during manufacture of the transformer. An indicative in inspection is given in this specification.

This is, however, not intended to form a comprehensive program as it is contractor’s responsibility to draw up and carry out such a program duly approved by the CLIENT.

(ii) The contractor shall carry out type tests and routine tests on the transformers.

(iii) Only one no of transformer of each rating will be subjected to type tests as per relevant IEC in presence of authorized engineer(s) of CLIENT. The charges for conducting each of type tests shall be included in the bid price and no separate type test charges shall be paid.

(iv) The pre-shipment checks shall also be carried out by the contractor.

(v) The requirements on site tests are as listed in the specifications.

(vi) Certified test report and oscillograms shall be furnished to the CLIENT for evaluation as per the schedule of distribution of documents. The Contractor shall also evaluate the test results and rectify the defects in the equipment based on his and the CLIENT's evaluations of the tests without any extra charges to CLIENT. Manufacturer's Test Certificates in respect of all associated auxiliary and ancillary equipment shall be furnished.

(vii) The bidder shall state in his proposal the testing facilities available at his works. In case full testing facilities are not available, the bidder shall state the method proposed to be adopted so as to ascertain the transformer characteristics corresponding to full capacity.

(viii) CLIENT at its discretion may use its power analyser or the power analyser of authorized testing agency for determination of no load loss, no load current, load loss and % Impedance at the works of the manufacturer and the concerned stores/Testing Laboratory of CLIENT/Any other Government approved laboratory.

7.1. Inspection

i) Tank and Conservator

a) Inspection of major weld.
b) Crack detection of major strength weld seams by dye penetration test.
c) Check correct dimensions between wheels, demonstrate turning of wheels, through 900 and further dimensional check.
d) Leakage test of the conservator.

ii) Core

a) Sample testing of core materials for checking specific loss, properties, magnetization characteristics and thickness.
b) Check on the quality of varnish if used on the stampings.
c) Check on the amount of burrs.
d) Visual and dimensional check during assembly stage.
e) Check on completed core for measurement of iron loss, determination of maximum flux density. (Determination of gross and net cross sectional area of the core & no. of turns/Phase.)
f) Visual and dimensional checks for straightness and roundness of core, thickness of limbs and suitability of clamps.
g) High voltage DC test (2 KV for one minute) between core and clamps.

iii) iii) Insulating Material

a) Sample check for physical properties of materials.
b) Check for dielectric strength
c) Check for the reaction of hot oil on insulating materials.

iv) Winding

a) Sample check on winding conductor for mechanical and electrical conductivity.
b) Visual and dimensional checks on conductor for scratches, dent mark etc.
c) Sample check on insulating paper for PH value, electric strength.
d) Check for the bonding of the insulating paper with conductor.
e) Check and ensure that physical condition of all materials taken for windings is satisfactory and free of dust.
f) Check for absence of short circuit between parallel strands.

v) Checks Before Drying Process

a) Check condition of insulation on the conductor and between the windings.
b) Check insulation distance between high voltage connections, between high voltage connection cables and earth and other live parts.
c) Check insulating distances between low voltage connections and earth and other parts.
d) Insulating test for core earthing.

vi) Check During Drying Process

a) Measurement and recording of temperature and drying time during vacuum treatment.
b) Check for completeness of drying

vii) Assembled Transformer

a) Check completed transformer against approved outline drawing, provision for all fittings, finish level etc.
b) Jacking test on the assembled Transformer.

viii) Oil

All standard tests in accordance with relevant standards shall be carried out on Transformer oil sample before filling in the transformer.

ix) Test Report for bought out items

The contractor shall submit the test reports for all bought out / sub contracted items for approval.

a) Buchholz relay
b) Sudden pressure rise relay on Main Tank
c) Winding temperature indicators (for TX capacity 5 MVA)
d) Oil temperature indicators
e) Bushings
f) Bushing current transformers in neutral (If Provided)
g) Marshalling box
h) Off Load Tap changer for MVA Transformer
i) Any other item required to complete the works.

j) Porcelain, bushings, bushing current transformers, wherever provided, winding coolers, control devices, insulating oil and other associated equipment shall be tested by the contractor in accordance with relevant standards. If such requirement is purchased by the contractor on a sub-contract, he shall have them tested to comply with these requirements.

7.2. Factory tests

i) All standards routine tests in accordance IEC with dielectric tests corresponding as per latest amendments shall be carried out.
ii) All auxiliary equipment shall be tested as per the relevant IEC. Test certificates shall be submitted for bought out items.
iii) High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.
iv) Following additional routine tests shall also be carried out on each transformer:

a) Magnetic Circuit Test
Each core shall be tested for 1 minute at 2000 Volt DC
b) Oil leakage test on transformer

7.2.1. Type tests

The transformer shall be subjected to the following type tests particularly Short circuit and Impulse withstand tests at CPRI. Before conducting the short circuit test and Impulse test, the firm will offer for both stage inspection and final inspection of the transformer by CLIENT at the manufacturer's works. If the transformer complies with the specification and offered technical parameters, the transformer will be sealed by authorized engineer(s) of CLIENT and thereafter the transformer can be transported to standard test laboratories for required type tests in presence of CLIENT's authorized representative(s) who will verify the seal & allow for conducting the type tests.

The Type Tests shall include:-

(1) Tan delta measurement and capacitance of each winding to earth (with all other windings earthed) & between all windings connected together to earth.
(2) Measurement of Zero sequence impedance.
(3) Temperature Rise Test
(4) Short Circuit Test
(5) Tank Vacuum test
(6) Tank Pressure Test
(7) Lightning impulse withstand test for line and neutral terminal.
(8) Measurement of acoustic noise level.

7.2.2. Stage inspection

The supplier shall offer the core, windings and tank of each transformer for inspection by the CLIENT's representative(s). During stage Inspection, all the measurements like diameter, window height, leg centre, stack width, stack thickness, thickness of laminations etc. for core assembly, conductor size, Insulation thickness,

I.D., O.D, winding height, major and minor insulations for both H.V and L.V windings, length, breadth, height and thickness of plates of Transformer tank, the quality of fittings and accessories will be taken / determined. The supplier can offer for final inspection of the transformers subject to clearance of the stage Inspection report by the CLIENT. No. of turns is to be determined by wrapping known No. of turns across LV winding and determining the turns ratio by ratio meter.

7.2.3. **Routine tests**

Transformer routine tests shall include tests stated in latest issue of IEC. These tests shall also include but shall not be limited to the following:

(i) Measurement of winding DC resistance.
(ii) Voltage ratio on each tapping and check of voltage vector relationship.
(iii) Impedance voltage at all tapping.
(iv) Magnetic circuit test as per relevant standards
(v) Measurement of Load losses at normal tap and extreme taps.
(vi) No load losses and no load current at rated voltage and rated frequency, also at 25% to 121 % of rated voltage in steps.
(vii) Absorption index i.e insulation resistance for 15 seconds and 60 seconds (R 60/ R 15) and polarization index i.e Insulation Resistance for 10 minutes and one minute (R 10 mt / R 1 mt).
(viii) Induced over voltage withstand test.
(ix) Separate source voltage withstand test.
(x) Tan delta measurement and capacitance of each winding to earth (with all other windings earthed) & between all windings connected together to earth.
(xi) Measurement of zero sequence impedance
(xii) Tests on On- Load tap changer (fully assembled on transformer) as per IEC: 214/ 1976 and BS: 4571/ 1970.
(xiii) Auxiliary circuit tests
(xiv) Oil BDV tests
(xv) Measurement of neutral unbalance current which shall not exceed 2% of the full rated current of the transformer.
(xvi) Magnetic balance test
(xvii) Leakage test.

Six (6) set of certified test reports and oscillographs shall be submitted for evaluation prior to dispatch of the equipment. The contractor shall also evaluate the test results and shall correct any defect indicated by his and CLIENT's evaluation of the tests without charge to the CLIENT.

7.2.4. **Tank tests**

a) Oil leakage Test

The tank and oil filled compartments shall be tested for oil tightness completely filled with air or oil of viscosity not greater than that of insulating oil conforming to relevant standards: 335 at the ambient temperature and applying a pressure equal to the normal pressure plus 35 KN/ m^2 measured at the base of the tank.

The pressure shall be maintained for a period of not less than 12 hours of oil and one hour for air and during that time no leak shall occur.

b) Pressure Test

Where required by the CLIENT, one transformer tank of each size together with its radiator, conservator vessel and other fittings shall be subjected to a pressure corresponding to twice the normal head of oil or to the normal pressure plus 35 KN / m2 whichever is lower, measured at the base of the tank and maintained for one hour.

c) Vacuum Test

One transformer tank of each size shall be subjected to the vacuum pressure of 60 mm of mercury. The tanks designed for full vacuum shall be tested at an internal pressure of 3.33 KN/m2 (25 mm of mercury) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the value with relevant IEC standards.

7.2.5. Pre-shipment check at manufacturers works

i) Check for proper packing and preservation of accessories like radiators, bushings, explosions vent, dehydrating breather, rollers, buchholz relay, control cubicle connecting pipes and conservator etc.
ii) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.
iii) Gas tightness test to conform tightness.

7.2.6. Inspection and testing at site

The Engineer authorized from CLIENT along with the contractor's site engineer shall carry out detailed inspection covering areas right from the receipt of material up to commissioning stage. An indicative program of inspection as envisaged by the Engineer is given below.

7.2.7. Receipt and storage checks

i) Check and record conditions of each package visible parts of the transformers etc for any damage.
ii) Visual check of core and coils before filling up with oil and also check condition of core and winding in general.

7.2.8. Installation checks

i) Inspection and performance testing of accessories like tap changers etc.
ii) Check choking of the tubes of radiators
iii) Test on oil samples taken from main tank top and bottom and cooling system. Samples should be taken only after the oil has been allowed to settle for 24 hours.

iv) Check the whole assembly for tightness, general appearance etc.
v) Oil leakage tests.

7.2.9. Pre-commissioning tests

After the transformer is installed, the following pre-commissioning tests and checks shall be done before putting the transformer in service.

i) Dry out test
ii) Megger Test
iii) DC Resistance measurement of windings
iv) Ratio test on all taps
v) Phase relationship test (Vector grouping test)
vi) Buchholz relay alarm & surge operation test
vii) Low oil level (in conservator) alarm
viii) Temperature Indicators
ix) Marshalling kiosk
x) Protective relays
xi) Magnetising current
xii) Tests on OLTC

7.2.10. The following additional checks shall be made:

i) All oil valves are incorrect position closed or opened as required
ii) All air pocket are cleared.
iii) Thermometer pockets are filled with oil.
iv) Oil is at correct level in the bushing, conservator, diverter switch & tank etc.
v) Earthing connections are made.
vi) Colour of Silica gel is blue.
vii) Bushing arcing horn is set correctly and gap distance is recorded.
viii) C T polarity and ratio is correct.

8. Performance

The performance of the transformer shall be measured on the following aspects.

i) The transformer shall be capable of being operated without danger on any tapping at the rated KVA with voltage variations and ± 10% corresponding to the voltage of the tapping
ii) Radio interference and Noise Level
iii) The transformer shall be designed with particular attention to the suppression of third and fifth harmonics so as to minimize interference with communication circuits.

8.1. Fault conditions

1. The transformer shall be capable of withstanding for two(2) seconds without damages any external short circuit to earth

2. Transformer shall be capable of withstanding thermal and mechanical stresses conveyed by symmetrical or asymmetrical faults on any winding. This shall be demonstrated through calculation as per relevant standards.

3. Transformer shall accept, without injurious heating, combined voltage and frequency fluctuation which produce the 125% over fluxing condition for one minute and 140% for 5 seconds. Certified test report and oscillograms shall be furnished to the CLIENT for evaluation as per the schedule of distribution of documents. The Contractor shall also evaluate the test results and rectify the defects in the equipment based on his and the CLIENT's evaluations of the tests without any extra charges to the CLIENT. Manufacturer's Test Certificates in respect of all associated auxiliary and ancillary equipment shall be furnished.

The bidder shall state in his proposal the testing facilities available at his works. In case full testing facilities are not available, the bidder shall sate the method proposed to be adopted so as to ascertain the transformer characteristics corresponding to full capacity testing.

9. Losses

Sl. No.	Transformer Rating	Maximum No- Load Loss in KW at rated voltage & frequency	Maximum Load Loss in KW at 750C at normal tap position & rated frequency
1	3 33/11 KV, 8 MVA	4.5	38

N.B: There shall be no positive tolerance to above losses. Capitalization of losses shall not be factored in the comparative statement for selection of vendors.

10. Spare parts

In case the manufacturer goes out of production of spare parts, then he shall make available the drawings of spare parts and specification of materials at no extra cost to the CLIENT to fabricate or procure spare parts from other sources.

Mandatory Spare Parts

The suppliers shall provide the following mandatory spare s for each of Transformer supplied

H.V. & L.V. Bushing & Studs –Each 2 Nos
Bimetallic connector for H.V & L.V. Bushings – Each 2 sets

11. Instruction manual

Eight sets of the instruction manuals shall be supplied at least four (4) weeks before the actual dispatch of equipment. The manuals shall be in bound volumes and shall contain all the drawings and information required for erection, operation and maintenance of the transformer. The manuals shall include amongst other, the following particular:

1. Marked erection prints identifying the components, parts of the transformer as dispatched with assembly drawings.
2. Detailed dimensions, assembly and description of all auxiliaries.
3. Detailed views of the core and winding assembly, winding connections and tapings tap changer construction etc. These drawings are required for carrying out overhauling operation at site.
4. Salient technical particulars of the transformer.
5. Copies of all final approved drawings.
6. Detailed O&M instructions with periodical check lists and Performa etc.

11.1. Completeness of equipment

All fittings and accessories, which may not be specifically mentioned in the specification but which are necessary for the satisfactory operation of the transformer, shall be deemed to be included in the specification and shall be furnished by the supplier without any extra charge. The equipment shall be complete in all details whether such details are mentioned in the specification or not, without any financial liability to the CLIENT under any circumstances.

11.2. Tools and tackles

All the necessary tools and tackles required for normal operation & maintenance of the transformers shall be supplied by the Contractor.

12. Commissioning

The equipments shall be commissioned as per relevant standards and manufacturer's recommendations. All the related drawings and manuals shall be pre-requisite for release of final payment.

ANNEXURE – I
(Technical Data Schedule for 8 MVA, 33/11kV Power Transformers)

Sl. No.	Description	Bidder's offer
1.	Name and address of the Manufacturer	
a)	Transformer	
b)	HV & LV Bushings	
c)	Bimetallic connectors	
d)	Transformer Oil	
e)	On load tap changer	
f)	Instruments	
g)	Neutral Bushing CTs	
2.	Service (Indoor / Outdoor)	
3.	Normal continuous rating in KVA under site conditions at all taps :	
a)	HV winding (KVA)	
b)	LV winding (KVA)	
4.	Rated Voltage	
a)	HV winding (KV)	
b)	LV winding (KV)	
5.	Rated frequency (Hz)	
6.	No. of phases	
7.	Type of transformer	
8.	Connections	
a)	HV winding	
b)	LV winding	
9.	Connections symbols	
	HV – LV	
10.	Tappings	
a)	Range	
b)	Number of steps	
c)	Position of tapping on HT winding for high voltage variation	
11.	Reference ambient temperatures	
a)	Maximum ambient air temperature (ºC)	
b)	Maximum daily average ambient temperature (ºC)	
c)	Minimum ambient air temperature (ºC)	
d)	Maximum yearly weighted average ambient temperature (ºC)	
12.	Maximum temperature rise over ambient temperature	
a)	Top oil by thermometer (ºC)	
b)	HV & LV windings by resistance measurement (ºC)	
c)	Hot Spot Temperature rise of windings(ºC)	

Sl. No.	Description	Bidder's offer
d)	Limit for hot spot temperature for which the transformer is designed (º C)	
e)	Temperature gradient between windings and oil (ºC)	
f)	Type of maximum winding temperature indicator (ºC)	
13.	Voltage to earth for which the star point will be insulated	
14.	Cooling type	
15.	Losses	
a)	No-Load loss at rated voltage & rated frequency (KW)	
b)	Load loss at rated current at Normal Tap at 75ºC (KW)	
16.	Max. Current density in winding at rated current for normal tap position	
a)	HV winding (Amps/ sq.mm.)	
b)	LV winding (Amps / sq.mm.)	
17.	Impedance voltage at rated current, rated frequency and at 75ºC expressed as percentage of rated voltage at	
a)	Principal (normal) tap (%)	
b)	Highest tap (%)	
c)	Lowest tap (%)	
18.	Reactance at rated current & frequency as percentage of rated voltage at:	
a)	Principal (normal) tap	
b)	Highest Tap	
c)	Lowest Tap	
19.	Resistance at 75º C	
a)	H.V. winding at normal tap position	
b)	L.V. winding	
c)	Resistance voltage drop at 75º C winding temperature expressed as percent of rated voltage (%)	
	i) Principal/ normal tap	
	ii) Highest tap	
	iii) Lowest tap	
20.	Insulation level	
a)	Separate source power frequency voltage withstand	
	i) HV winding (KV rms)	
	ii) LV winding (KV rms)	
b)	Induced over voltage withstand	
	i) HV winding (KV rms)	

Sl. No.	Description	Bidder's offer
	ii) LV winding (KV rms)	
c)	Full wave lightning impulse withstand voltage	
d)	Power frequency high voltage tests	
	i) Test voltage for one minute withstand test on high voltage windings (induced)	
	ii) Test voltage for one minute withstand test on low voltage windings	
	iii) Test voltage for one minute withstand test on neutral end of low voltage windings	
e)	Lightning impulse withstand tests	
	i) Impulse test on high voltage winding 1.2/50 µ sec full wave withstand (KV peak)	
	ii) Impulse test on low voltage winding 1.2/50 µ sec full wave withstand (KV peak)	
	iii) Wave form for impulse test	
21.	No load current, no load loss, no load power factor at normal ratio and frequency (Amp/ KW/ P.F.)	
a)	10 percent of rated voltage	
b)	25 percent of rated voltage	
c)	50 percent of rated voltage	
d)	85 percent of rated voltage	
e)	100 percent of rated voltage	
f)	105 percent of rated voltage	
g)	110 percent of rated voltage	
h)	112.5 percent of rated voltage	
i)	115 percent of rated voltage	
j)	120 percent of rated voltage	
k)	121 percent of rated voltage	
22.	Efficiency at 75º C at unity power factor	
a)	Full load	
b)	75% load	
c)	50% load	
d)	25% load	
23 (a)	The minimum percentage of load at which the transformer will run at maximum efficiency (%)	
b)	Maximum efficiency of the transformer	
24.	Regulation at full load at 75º C	
a)	At unity power factor (%)	
b)	At 0.8 power factor (lagging) (%)	
25.	Core data	
a)	Grade of core material used	

Sl. No.	Description	Bidder's offer
b)	Thickness of core plate lamination (mm)	
c)	Whether core laminations are of HIB cold rolled grain oriented	
d)	Details of oil ducts in core, if any	
	i) Whether in the plane & at right angle to the plane of winding	
	ii) Across the plane of lamination	
e)	i) Insulation of core lamination	
	ii) Insulation of core plates	
	iii) Type of core joints(Mitred or Mitred Step-lap)	
26.	Flux density	
a)	Designed maximum flux density at rated voltage and rated frequency (Tesla)	
b)	Designed maximum operating flux density which the transformer can withstand for one minute at normal tap (Tesla)	
c)	Designed maximum operating flux density which the transformer can withstand for five seconds at normal tap (Tesla)	
27.	Inter-Tap insulation	
a)	Extent of extreme end turns reinforcement	
b)	Extent of end turns reinforcement	
c)	Extent of turn adjacent to tapping reinforced	
d)	Test voltage for 10 seconds 50Hz inter-turn insulation test on (a)	
e)	Test voltage for 10 seconds 50Hz inter-turn insulation test on (b)	
f)	Test voltage for 10 seconds 50Hz inter-turn insulation test on (c)	
28.	Windings:	
a)	Material	
b)	Type of windings:	
	i) HV windings	
	ii) LV windings	
c)	Insulation of HV windings	
d)	Insulation of LV windings	
e)	Insulation between HV & LV windings	
29.	Continuous rating under following conditions:	
a)	At 40ºC ambient air temp. at site	
b)	At 30ºC ambient air temp. at site	
c)	At 20ºC ambient air temp. at site	
30.	Transformer Tank	
a)	Material	

Sl. No.	Description	Bidder's offer
b)	Thickness	
	- Top	
	- Sides	
	- Bottom	
c)	Details of painting	
	- Inner surface	
	- Outer surface	
31.	Dimensions of 3 phase transformers:	
a)	Max. Height to top of bushings (mm)	
b)	Over-all length (mm)	
c)	Over-all breadth (mm)	
32.	Weight data of transformer components : (Tolerance + 5%) (approximate values not allowed)	
a)	Core excluding clamping (Kg)	
b)	Core with clamping (Kg)	
c)	HV winding insulated conductor (Kg)	
d)	LV winding Insulated conductor (Kg)	
e)	Coils with insulation (Kg.)	
f)	Core and windings (Kg)	
g)	Weight of steel (Kg)	
h)	Fittings and accessories (Kg)	
i)	Oil required for first filling including 10% extra (ltrs / Kg)	
	1. Oil in main tank (Ltrs)	
	2. Oil in the conservator (Ltrs)	
	3. Oil in the radiators (Ltrs)	
	4. Oil in the OLTC (Ltrs.)	
	5. Overall total quantity of oil with 10% extra oil for first filling (ltrs / Kg)	
j)	1. Transportation weight excluding accessories (Kg)	
	2. Shipping details	
	i) Weight of heaviest package (Kg.)	
	ii) Dimension of largest package (Kg)	
k)	Untanking weight (Kg)	
l)	Total weight of transformer with oil and fittings (Kg)	
33.	Bushing data :	
a)	Type of bushing insulator	
	i) HV	
	ii) LV	
	iii) Neutral	
b)	Material of bushing (inner part / outer part)	
c)	Weight of bushing insulator (Kg.)	

Sl. No.	Description	Bidder's offer
d)	Quantity of oil in one bushing (lt.)	
e)	Minimum dry withstand & flash over power frequency voltage of bushing (KV)	
f)	Minimum wet withstand & flash over power frequency voltage of bushing (KV)	
g)	Minimum withstand & flashover impulse level (KV)	
h)	Voltage rating (KV)	
i)	Current rating (Amps.)	
j)	Thermal Short Time current & Duration	
k)	Rated Dynamic current & its duration	
l)	Cantilever with stand loading	
m)	Clearance in oil	
	- phase to phase (mm)	
	- phase to earth (mm)	
n)	Creepage distance in oil & air (mm)	
o)	Minimum level of immersing / medium (oil) (mm)	
p)	Maximum pressure of immersing medium (oil) Kg/ cm^2	
q)	Free space required at top for removal of bushings (mm)	
r)	Angle of mounting	
34.	Details of CT to be provided in the neutral for REF protection.	
a)	Outdoor bushing type	
b)	No. of cores and their function	
c)	Location (Line / Neutral)	
d)	Current rating for various cores (Primary / Secondary)	
e)	VA burden / Knee Point voltage (Core wise)	
f)	Magnetising current at half knee point voltage. (mA)	
g)	Classification (PS class) core wise	
h)	Test voltage	
i)	Construction details	
35.	Conservator (Main Transformer and OLTC)	
a)	Total volume of the Conservator (Cub mtr / Ltr.)	
b)	Volume of the conservator between the highest and lowest level (Cubic mtr. / Ltrs)	
36.	Calculated time constants for natural cooling	
37.	Type of axial coil supports :	
a)	HV winding	

Sl. No.	Description	Bidder's offer
b)	LV winding	
38.	Details of On Load tap changer	
a)	Make	
b)	Type	
c)	Rating	
	i) Rated Voltage	
	ii) Rated current	
	iii) Step voltage	
	iv) Number of steps	
	v)Rated Short Circuit Current	
d)	Whether Diverter switch provided with gas vent and buchholz relay (Yes / No)	
e)	Whether a separate oil surge relay with trip contacts provided (Yes / No)	
f)	Pressure relief valve	
g)	Details of motor device unit housed in kiosk / mounted on tap changer	
h)	Whether Remote control panel provided with Control scheme for simultaneous operation of Tap changer when transformers are running in parallel and independent control when in independent operation.	
i)	Details of equipment in the OLTC kiosk	
j)	Details of OLTC panels	
	i) automatic tap changer relay	
	ii) literature of all the relays	
	iii) dimensions of OLTC, Panel L x B x H	
	iv) thickness of sheet	
	v) degree of protection	
	vi) details of equipment supplied	
39.	Dispatch details :	
a)	Approx. mass of heaviest Package (Kg)	
b)	Approx. dimensions of largest Package	
	i) Length (mm)	
	ii) Breadth (mm)	
	iii) Height (mm)	
40.	Un-tanking height (mm)	
41.	Bimetallic connectors V / LV	
a)	Normal current rating (A)	
b)	Short time current rating (A)	
c)	Tensile strength (Kg)	
d)	Maximum temperature limit	
e)	Dimensional sketch enclosed indicating tolerances (Yes/No)	

Sl. No.	Description	Bidder's offer
f)	Minimum clearance (mm)	
	- Phase to phase	
	- Phase to Earth	
42.	CORE ASSEMBLY :-	
a)	Core diameter (mm)	
b)	Core window height (mm)	
c)	Core leg centre (mm)	
d)	Gross core cross – sectional area (m^2)	
e)	Total height of core (mm)	
f)	Details of top end frame	
g)	Details of Bottom end frame	
h)	Details of clamp plate (material, thickness, insulation)	
i)	Total core weight (Kg)	
j)	Core loss, basing on core loss graph at operating flux density (rated voltage and rated frequency) (KW)	
k)	Core stacking factor	
l)	Net core area (Sq.m)	
m)	Margin towards corner joints, cross-fluxing, dielectric loss (KW)	
n)	Total core loss at rated voltage and rated frequency (KW)	
o)	Describe location / method of core grounding	
p)	Details of core- belting	
	i) Material , grade and type	
	ii) Width	
	iii) Thickness	
	iv) Fixing method	
43.	DETAILS OF WINDING	
a)	Type of winding	
b)	Material of the winding conductor	
c)	Maximum current density of windings at rated current and conductor area	
d)	Whether windings are pre-shrunk?	
e)	Whether adjustable coil clamps are provided for HV and LV windings?	
f)	Whether steel rings are used for the windings? If so, whether these are split?	
g)	Whether electrostatic shields are provided to obtain uniform voltage distribution in the windings?	
h)	Winding Insulation (Type & Class)	
i)	Insulating material, used for	

Sl. No.	Description	Bidder's offer
	i) H.V winding	
	ii) LV winding	
	iii) Tapping connection	
j)	Insulating material used between	
	i) L.V and H.V winding	
	ii) Core & L.V winding	
k)	H.V to H.V winding between phases	
l)	Type of axial supports	
	i) H.V winding	
	ii) L.V winding	
m)	Type of radial supports	
	i) H.V winding	
	ii) L.V winding	
n)	Maximum allowable torque on coil clamping bolts	
o)	Clamping ring details	
	i) Thickness of ring mm	
	ii) Diameter of ring mm	
	iii) No. & size of pressure screw	
p)	Bare conductor size (mm)	
	i) HV	
	ii) LV	
q)	Insulated conductor size (mm)	
	i) HV	
	ii) LV	
r)	No. of conductor in parallel (Nos.)	
	i) HV	
	ii) LV	
s)	No. of turns / phase	
	i) HV	
	ii) LV	
t)	No. of discs / phase	
	i) HV	
	ii) LV	
u)	No. of turns / Disc	
	i) HV	
	ii) LV	
v)	Gap between discs (mm)	
	i) HV	
	ii) LV	
w)	Inside diameter (mm)	
	i) HV	
	ii) LV	
x)	Outside diameter (mm)	
	i) HV	

Sl. No.	Description	Bidder's offer
	ii) LV	
y)	Axial height after shrinkage (mm)	
	i) HV	
	ii) LV	
z)	D.C Resistance	
i)	L.V winding at 75ºC (Ohms)	
ii)	H.V winding at normal tap at 75ºC (Ohms)	
iii)	H.V winding at highest tap at 75ºC (Ohms)	
iv)	H.V winding at lowest tap at 75ºC (Ohms)	
v)	Total I^2R losses at 75ºC for normal tap (KW)	
vi)	Total I^2R losses at 75º C for highest tap (KW)	
vii)	Total I^2R losses at 75º C for lowest tap (KW)	
viii)	Stray losses including eddy current losses in winding at 75ºC (KW)	
	a) Normal tap position	
	b) Highest tap position	
	c) Lowest tap position	
	d) Any special measures, taken to reduce eddy current losses and stray losses. Mention in details	
ix)	Load losses at 75º C (I^2 R + Stray)	
	a) Normal tap position (KW)	
	b) Highest tap position (KW)	
	c) Lowest tap position (KW)	
x)	Details of special arrangement, provided to improve surge voltage distribution in the windings.	
44.	DETAILS OF TANK :	
a)	Material of Transformer tank	
b)	Type of tank	
c)	Thickness of sheet (No approximate value to be mentioned)	
	i) Sides (mm)	
	ii) Bottom (mm)	
	iii) Cover (mm)	
	iv) Radiators (mm)	
d)	Inside dimensions of main tank (No approximation in dimensions to be used)	
	i) Length (mm)	
	ii) Breadth (mm)	
	iii) Height (mm)	
e)	Outside dimensions of main tank (No	

Sl. No.	Description	Bidder's offer
	approximation in dimensions to be used)	
	i) Length (mm)	
	ii) Breadth (mm)	
	iii) Height (mm)	
f)	Vacuum recommended for hot oil circulation (torr / mm of Hg)	
g)	Vacuum to be maintained during oil filling in transformer tank (torr / mm of Hg)	
h)	Vacuum to which the tank can be subjected without distortion (torr / mm of Hg)	
i)	No. of bi-directional wheels provided	
j)	Track gauge required for the wheels	
	i) Transverse axis	
	ii) Longitudinal axis	
k)	Type and make of pressure relief device and minimum pressure at which it operates (Kpa)	
45.	CONSERVATOR :-	
a)	Thickness of sheet (mm)	
b)	Size (Dia x length) (mm)	
c)	Total volume (Litres)	
d)	Volume between the highest and lowest visible oil levels (Litres)	

TECHNICAL SPECIFICATION FOR CURRENT TRANSFORMERS 33KV (OUT DOOR)

TECHNICAL SPECIFICATION FOR 33KV CURRENT TRANSFORMERS WITH METERING CORES

1. Scope

1.1. The specification covers the design, manufacture, assembly, inspection and testing at the manufacture's work, packing and delivery F.O.R. (destination) of the outdoor mounted dead tank type, single phase, single unit type current Transformers for protection and metering services in 33KV solidly grounded system.

1.2. The current transformers shall be of the outdoor type, single phase, 50 C/S, oil immersed, self cooled, hermetically sealed and suitable for operating in the tropical conditions with maximum ambient temperature up to 500C. The C.TS should be suitable for use in the areas subject to heavy lightning storms and highly polluted conditions.

1.3. Followings are the list of documents constituting this specification.

i. Technical specification(TS)
ii. Technical Requirements & General Requirement E21
iii. Calibration Status of testing equipments and meters / Instruments E21
iv. Check-List towards Type Test Reports E21

Note : E21 to be filled up by the Bidder

1.4. The current transformer shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or material which in his judgment is not in full accordance therewith.

1.5. Bidders are required to quote for 0.2 accuracy class of metering cores with the following data / information etc.

a) Guaranteed Technical particulars.
b) Technical literatures, brochures and drawings as per this specification.
c) Type Test Reports.
d) List of orders, executed and User's certificates, failing submission of the above particulars with the offer, the tender may not be considered for evaluation**.**

2. Standards

2.1. Except to the extent modified in the specification, the C.TS shall conform to the latest editions and amendments of the standards listed hereunder.

IEC-44	:	Instrument transformer-measurement of PDS
IEC-60	:	High Voltage Testing Technique.
IEC-171	:	Insulation co-ordination
IEC-185	:	Current Transformers.
IEC-270	:	Partial Discharge Measurement
IEC-8263	:	Method for RIV Test on High Voltage Insulators.
IEC	:	60376 SF6 Gas (for 220kv SF6 gas filled CTs only)

2.2. Current Transformers with the requirements of other authoritative standards, which ensure equal or better quality than the standards, mentioned above, shall also be acceptable, where the equipment, offered by the supplier conforms to other standards, salient points of difference between the standards adopted and specified standards shall be brought out in the offer. 4 (four) copies of the reference standards in English language shall be furnished along with the offer.

2.3. The supplier is to furnish the latest edition of the standards as mentioned above from SI.1 to Sl.15 with their amendments, if any, at their own cost, if required by the Purchaser.

2.4. All the above along with amendments thereof shall be read and interpreted together. However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this specification will prevail.

3. Climatic & service conditions

Please refer Technical Specification on climatic conditions.

3.1. Earthquake incidence

The current Transformers are to be designed to withstand earthquakes of an intensity equivalent to seismic acceleration of 0.3g in the horizontal direction and 0.15g in the vertical direction, where 'g' stands for acceleration due to gravity.

3.2. The current Transformers covered under this specification shall be suitable for outdoor installation.

4. General technical requirements

4.1. The C.T. shall be of dead tank design and shall be so constructed that it can be easily transported to site within the allowable limitation and in horizontal position if the transport limitations so demand. For compensation of variation in the oil volume due to ambient variation, nitrogen cushion / metal bellows shall be used. Rubber diaphragms shall not be permitted for this purpose.

4.2. The C.T. secondary terminals shall be brought out in a weather proof terminal box.

4.3. The terminal box shall be provided with removable gland plate and gland (s) suitable for 1100 volts grade PVC insulated, PVC sheathed, multi core 4 Sq. mm stranded copper conductor cable. The terminal blocks shall be stud-type and provided with ferrules indelibly marked or numbered. The terminals shall be rated for not less than 10 Amps. The terminal box shall be dust and vermin proof. Suitable arrangements shall be made for drying of air inside the secondary terminal box. The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with the use of normal tools.

Polarity shall be indelibly marked on each primary and secondary terminal. Facility shall be provided for short-circuiting and grounding of the C.T. secondary terminals inside the terminal box.

4.4. The C.T. shall be provided with non-corrosive, legible name plate with the information, specified in the relevant standards, duly engraved/punched on it.

4.5. The current Transformer shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture from entering the tanks. Oil filling and / or sampling cocks, if provided to facilitate factory processing should be properly sealed before dispatching the C.T., The method adopted for hermetic sealing shall be described in the offer.

4.6. The castings of base, collar etc. shall be die cast and tested before assembly to detect cracks and voids, if any.

4.7. The instrument security factor of metering core shall be low enough and not greater than '5'. This shall be demonstrated on all the ratios of the metering core in accordance with procedure, specified in IEC-185. In case the instrument security factor of 5 or less is not possible to be achieved on higher ratios, auxiliary CTS of ratio1/1 and 0.2 accuracy class shall be deemed to be included in the supplier's scope of supply.

This shall also be specifically brought out by the supplier in his offer. However, all parameters, specified shall have to be met treating auxiliary CT/ reactor as an integral part of the current Transformer. The auxiliary C.TS/reactor shall be inbuilt construction of the C.TS.

4.8. Current transformers' guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

4.9. For 36 KV Current Transformers, characteristics shall be such as to provide satisfactory performance for burdens ranging from 25% to 100% of rated burden over a range of 5% to 120% of rated current in case of metering CTS and up to accuracy limit factor / knee point voltage in case of relaying C.TS.

4.10. Current Transformers shall be designed so as to achieve the minimum risk of explosion in service. The Bidder shall bring out in his offer, the measures taken to achieve this.

5. Primary winding

Primary winding may be either ring type or hair pin type or the type, which has been type tested. For 33 / 11 KV class C.Ts, the rated extended primary current shall be 120% on all cores of the C.Ts, specified in tables.

The primary windings of current transformers shall be constructed of high purity, annealed, high conductivity electrolytic copper / Aluminium meeting to the requirements of IEC 28.

5.1. Secondary windings

5.1.1. Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. Type of insulation, used shall be described in the offer. The secondary taps shall be adequately reinforced to withstand handling without damage.

5.1.2. The rating of the Current Transformer's secondary winding shall be 1 (One) Amp. The secondary terminals shall be brought out in a compartment for easy access.

5.2. Primary terminals

5.2.1. The primary terminals shall be heavily tinned electrolytic copper or Aluminium alloy of 99.9% conductivity. The minimum thickness of tinning shall be 1.5 microns.

5.3. Secondary terminals

5.3.1. Secondary terminal studs shall be provided with at least three nuts and adequate plain and spring washers for fixing the leads. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum outside diameter of the stud shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The horizontal spacing between the centers of the adjacent studs shall be at least 1.5 times the outside circum-dia of the nuts.

5.3.2. The current transformer shall be provided with suitable test tap for measurement of capacitance, tan delta as well as partial discharges. Provision shall be made on a screw cap for solid and secured earthing of the test tap connection, when not in use. A suitable caution plate shall be provided duly fixed on the cover of the secondary terminal box indicating the purpose of the test tap and the necessity of its solid earthing as per prescribed method before energising the Current Transformer.

5.3.3. The secondary terminals shall be provided with shorting arrangements.

5.4. Core

5.4.1. Each core of the Current Transformer shall be of torroidal shape. Core laminations shall be of cold rolled grain oriented silicon steel or other equivalent alloys of low hysteresis and eddy current losses, high permeability to ensure high accuracy at both normal and over current conditions. The cores used for protection shall produce undistorted secondary current under transient conditions at all ratios, with specified Current Transformer parameters. The core material, thickness of lamination, the relevant graphs showing the characteristics of the core material shall be submitted along with the offer.

5.5. TANK

5.5.1. Both expansion chambers and the tanks of the Current Transformers shall be made up of high quality steel, which should be able to withstand full vacuums and pressure occurring during transit and thermal and mechanical stresses resulting from maximum short circuit current during operation. The tanks along with all ferrous parts shall be galvanised as per relevant standard.

5.5.2. The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. Welding in horizontal plane is to be avoided as welding at this location may give way due to vibrations during transport resulting in oil leakage. Supplier has to obtain specific approval from purchaser for any horizontal welding used in the bottom tank.

5.6. Secondary terminal box

5.6.1. Secondary Terminal Boxes shall be weather proof with a rating not less than IP 55

5.6.2. All secondary terminals shall be brought out in a compartment on one side of each current transformer for easy access.

5.6.3. The exterior of this terminal box shall be of aluminium alloy sheet of minimum 3 mm thickness.

5.6.4. A terminal board which shall have arrangement for series / parallel connection and arrangement for shorting of secondary terminals shall be provided. For 33 / 11 KV C.Ts, at least one of the ratios should be achieved through secondary tapping(s). I.e. primary re-connection is allowed for two ratios where as third ratio is to be achieved by provision of secondary tapping or alternatively all the stipulated ratios may be achieved through secondary tapping. Series parallel connection or by secondary tapping.

5.6.5. The terminal box shall be provided with a removable cable gland plate at bottom for mounting cable glands for 1.1KV PVC sheathed 3 nos. of 4x 4 Sq. mm stranded copper conductor cables.

5.6.6. The terminal box shall be provided with a door in front so as to have easy access of secondary terminals. The door shall have a sealing / locking arrangement and shall be suitable to prevent penetration of moisture and rain water.

5.6.7. All terminals shall be clearly marked with identification number to facilitate connection to external wiring.

5.6.8. The secondary box of the CT's also of high quality steel materials with galvanizing as per relevant standard.

5.7. Porcelain housing

5.7.1. The housing shall be made up of homogeneous, vitreous porcelain of high mechanical and dielectric strength, Glazing of porcelain shall be of uniform brown or dark brown colour with a smooth surface, arranged to shed away rain water or condensed water particles (fog.) The details of location and type of joint, if provided on the porcelain, shall be furnished by the Bidder along with the offer.

5.7.2. The bushings of the Current Transformers shall conform relevant standards.

5.7.3. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.

5.7.4. The bushings shall have ample insulation, mechanical strength and rigidity for the condition under which they shall be used and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove the internal heat.

5.7.5. Cast metal end caps for the bushings shall be of high strength, hot dip galvanized malleable iron. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionization.

5.7.6. The insulation of bushings shall be coordinated with that of the current transformer such that the flashover, if any, will occur only external to the Current Transformer.

5.7.7. Oil level gauge and convenient means of filling, sampling and draining of oil should be provided.

5.7.8. End shields should be provided for distribution of stresses.

5.7.9. Corona shields for bushings, if required should be provided.

5.8. Insulating medium (oil type)

The quantity of insulating oil for the filling and the complete specification of the insulating oil shall be stated. The oil shall comply in all respects with the provisions of relevant standards.

The current Transformers shall be supplied, filled with purified oil completely.

5.8.1. Prevention of oil leakage and entry of moisture:

The supplier shall ensure that the sealing of the Current Transformer is properly achieved. In this connection, the arrangement provided by the supplier at various locations including the following ones shall be described, supported by sectional drawings.

(a) locations of emergence of primary and secondary terminals.
(b) Interface between porcelain housing and metal tank/s
(c) Cover of the secondary terminal box.

5.8.2. Nuts and bolts or screws, used for fixation of the interfacing porcelain bushings for taking out terminals shall be provided on flanges, cemented to the bushings and not on the porcelain.

5.8.3. For gasket joints, wherever used, nitrite butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.

5.9. Fittings and accessories

Fittings and accessories, listed below shall be supplied with each Current Transformer.

Any fitting, required essential other than those listed below shall also be supplied along with each Current Transformer without any extra cost to the purchaser:

(a) Oil level gauge.
(b) Oil filling hole and cap.

(c) Pressure relieving device.
(d) Phase terminal connectors.
(e) Lifting lugs for core and windings, bushings and complete Current Transformers.
(f) Tank earthing pads/terminals with necessary nuts, bolts and washers for connecting to earth strip.
(g) Name / Rating plate.

5.9.1. **(A) Oil level gauge**

An oil level gauge shall be provided to indicate the oil level in the Current Transformer. This gauge shall be mounted in such a way that the oil level can be seen from ground level. If metal bellow is used, a ground glass window shall be provided to monitor the position of the metal bellow. The metal below shall be tested in accordance with relevant standards. The details shall be to the approval of the purchaser.

5.9.2. **Pressure relieving device**

Each Current Transformer shall be provided with a pressure relieving device so as to protect bushing of the Current Transformer even under unfavourable conditions. In case of non provision of the PRD, the same should be brought out clearly in the offer with detailed explanation and proof.

5.9.3. **Oil drain cock**

An oil drain cock along with a stop cock shall be provided in the bottom flange so as to permit taking of oil samples for testing, if required.

5.9.4. **Earthing**

Metal tank of each Current Transformer shall be provided with two separate earthing terminals for bolted connection to 50mm X 6 mm flat, to be provided by the purchaser for connection to station earth-mat.

5.9.5. **Lifting arrangement**

The Current Transformer shall be provided with suitable lifting arrangement to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing. Lifting arrangement (lifting eye) shall be positioned in such a way so as to avoid any damage to the porcelain housing or the tanks during lifting for installation / transport. Necessary string guides shall be offered which shall be of removable type.

5.9.6. **Name plate & marking**

5.9.6.1. The Current Transformer shall be provided with non-corrosive, legible name plate with the information specified in relevant standards, duly engraved/punched on it.

5.9.6.2. A schematic drawing indicating the connections shall be provided in the interior of the Terminal box.

5.9.7. **Terminal connectors**

All the Current Transformers shall be provided with bimetallic solder less clamp type, rigid type terminal connectors, suitable for

33 / 11 KV C.T. – AAAC conductor.

Each terminal connector shall be of universal type, suitable for both horizontal and vertical connections to the transmission line conductors / station bus bars.

5.9.7.1. Terminal connectors shall be manufactured and tested as per relevant standards.

5.9.7.2. All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

5.9.7.3. No part of a clamp shall be less than 10mm thick.

5.9.7.4. All ferrous parts shall be hot-dip galvanised conforming to relevant standard.

5.9.7.5. For bimetallic connectors, copper alloy linear of minimum thickness of 2 mm shall be cast integral with aluminium body.

5.9.7.6. All current carrying parts shall be designed and manufactured to have minimum contact resistance.

5.9.7.7. Connectors shall be designed to be corona free in accordance with the requirements, as per relevant standards.

6. Test

6.1. Type tests & special tests

The current transformers, offered should have been subjected to the following type tests and Special Tests in Government approved test laboratory. The bidder shall furnish four sets of type test and Special Tests reports along with the offer for 0.2 accuracy class CTs. These tests should not have been conducted earlier than five years from the date of opening of the bid. For any change in the design/type already type tested and the design / type offered against this specification, the purchaser reserves the right to demand repetition of some or all type & special tests without any extra cost to CLIENT in the presence of CLIENT's representative(s) at the cost of the supplier.

(a) Lightning Impulse Voltage Test.
(b) High Voltage power frequency wet withstands voltage Test.
(c) Short time current test.
(d) Temperature rise test.

(e) Determination of errors or other characteristics according to the requirements of the appropriate designation and accuracy class as per as per relevant standards.
(f) Instrument Security Factor Test.
(g) IP-55 Test on Secondary Terminal Box.

N.B:

- Lightning Impulse Test, switching Impulse Voltage test and High Voltage power frequency wet withstand voltage Tests should have been carried out on the same current transformer.
- After the current transformers have been subjected to lightning Impulse Test, and High Voltage power frequency wet withstand voltage tests, these must have been subjected to all the routine tests as per relevant standards.
-

6.2. Routine tests

The following routine tests shall be conducted on each Current Transformer in the presence of CLIENT's representative(s) for which no charges will be payable by CLIENT.

No sampling will be allowed.

i) Appearance and Dimensional Check.
ii) Verification of Terminal Marking and polarity.
iii) Verification of all individual parts / components of the Current Transformer so as to ensure to have complied the above specification.
iv) Measurement of Insulation Resistance.
v) Power frequency dry withstanding test on Primary and Secondary winding including primary intersections.
vi) Over – Voltage Inter turn test.
vii) Partial discharge Test
viii) Knee point voltage and Excitation current measurement for 'PS' class cores.
ix) Secondary winding resistance measurement.
x) Determination of errors.
xi) ISF Test.
xii) Leakage Test.
xiii) Magnetization Characteristics of the Current Transformers.
xiv) Turn ratio error on 'PS' class cores.
xv) Measurement of capacitance
xvi) Measurement of tan delta at 0.3, 0.7, 1.0 and 1.lUм/√3 for 33 / 11 KV C.Ts.

The Method For Conducting Partial Discharge Test.

The test circuit for the measurement of partial discharge (PD) should have been in accordance with sub-clause 4.2 of IEC-270. The applied voltage should be raised to the rated voltage of the Current Transformers and should have been maintained for a period greater than or equal to 10 seconds. The voltage should have been reduced to measuring voltage as specified in the relevant standards and maintained for a period greater than or equal to 1 minute. The PD should not exceed 10 Pico-coulombs.

7. Inspection

7.1. The purchaser shall have access at all times to the works and all other places of manufacture, where the Current Transformers are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacture of all the accessories and for conducting the necessary tests.

7.2. The supplier shall keep the purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangement could be made for inspection.

7.3. No material shall be despatched from its point of manufacture unless the material has been satisfactorily inspected, tested and despatch clearance issued. However, the purchaser reserves the right to alter the despatch schedule, attached to this specification without any extra financial liability to CLIENT.

7.3.1. The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are found to be defective.

8. Documentation

8.1. All drawings shall conform to relevant Indian Standard as per relevant standards. All drawings shall be in ink and suitable for microfilming. All dimensions and data shall be in S.I. units.

8.2. The supplier shall furnish four sets of following drawings/documents along with his offer for 0.2 accuracy class metering core CTs.

(a) General outline and assembly drawings of the Current Transformers.
(b) Sectional views showing.
  i) General constructional features.
  ii) Materials / gaskets / sealing used.
  iii) The insulation of the winding arrangement, method of connection of the primary / secondary winding to the primary / secondary terminals etc.
(c) Schematic drawing
(d) Rating and Diagram plate.
(e) Secondary Terminal Box.
(f) Assembly Sectional view of Primary Terminal
(g) Assembly drawing for secondary terminal.
(h) The detailed dimensional drawing of Porcelain Housing such as ID, OD, thickness and Insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.
(i) Sectional view of Pressure Release device.
(j) Drawing showing details of Oil level Indicator.
(k) All type and special test reports relating to tests, as mentioned at Cl. No. 6.1 of this Technical Specification.
(l) Ratio and phase angle error curves for CTS.

(m) Magnetization characteristic curves such as B-H curves and sp.loss vs. flux density curves.
(n) Drawings for Terminal Connector.

9. Test reports

(i) A set of type test and special test reports if any shall be furnished to the purchaser during detailed Engineering & drawing approval.
(ii) Copies of acceptance test reports and routine test reports shall be furnished to the purchaser. One copy will be returned, duly certified by the purchaser and only thereafter shall the materials be despatched.
(iii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the purchaser.
(iv) All test reports of tests, conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when required by the purchaser.

TECHNICAL SPECIFICATION FOR SUB STATION STRUCTURE

SUBSTATION STRUCTURES

1. Scope

All the galvanized Substation Structures shall be provided by the Contractor.

2. Standards

The steel materials shall comply with the requirements of as per relevant standards

3. Column structure

The H Pole structures are to be constructed with two parallel run 7.5 Meter meter long 150 x 76 x 6.5 mm G.I. Channels. Both the channels are separated by 150 mm distance (run through the entire length). The channels are further connected with 22 No. stiffeners (11 on each side) of size 100 x 270 x 5.7mm G.I. Flats welded to both the channels along 75 mm side (separated by 150 mm).

At the bottom the column is fixed with a BASE Plate (i) 620 x 620 x 12 mm galvanized & 6 Nos. of 33.5 mm dia holes for taking foundation bolts of size 32 mm dia 1400 mm long. On both sides of the channels (300 mm side) two nos. of stiffeners (ii) are welded with base plate and on 150 mm side two stiffeners (iii) are welded with base plate.

4. Beams / girders

The girders / beams shall be fabricated from galvanized 125 x 65 x 5.3mm channels as per the drawings / field requirements.

5. Dimensions and properties

MC DESIGNATION	**150 x 76 mm MC** (Minimum)	**125 x 65 mm MC** (Minimum)
Weight kg/m “M”	17.7	13.1
Sectional Area (cm2) “a”	22.6	16.7
Depth of Section (mm) “D”	150	125
Width of Flange (mm) “B”	76	65
Thickness of Flange (mm) “t”	6.5	5.3
Thickness of Web (mm) ”T”	9.00	8.2
Corner Radius (mm) “R_1”	10.00	9.5
Moment of Inertia (cm^4)	813.00	425
I_{xx}		
I_{yy}	110	61.1
Radius of Gyration (cm)	6.00	5.05
R_{xx}		
R_{yy}	2.20	1.91
Length in Meter	7500 mm	

MC DESIGNATION	150 x 76 mm MC (Minimum)	125 x 65 mm MC (Minimum)
"T_1" &" "T_2"	6000 mm	5000 (33kV)

* where MC refers to the classification of the channels as Indian Standard Medium Weight Channels.

- Holes should be provided for fixing the foundation bolts as specified above and as per the drawings for the above column structures.

6. Tests

6.1. All steel channels and other steel sections used in the manufacture of structures shall have been be type tested with respect to their calculated working and ultimate tensile failure loads utilizing the mechanical properties as per relevant standards.

6.2. Transverse Strength Test for Steel Sections

The steel sections may be tested in either a horizontal or vertical position. If tested in the horizontal position, provisions shall be made to compensate for the overhanging weight of the column.

For this purpose the overhanging portion of the column shall be supported on a moveable trolley or similar device.

The pole shall be rigidly supported at the butt end for a distance equal to the designed depth of planting.

The working load on the column should correspond to those that are likely to come onto the column during it's working life. The offered designs shall meet system requirements with the point of application of the working loads as per the Bidder's design but not more than 600 mm from the top of the column.

The steel column shall be deemed to have passed the test if no permanent deformation is visible at the rigidly supported end and the permanent set at the point of load application does not exceed 13 mm.

The load shall then be reduced to zero and increased gradually to a load equal to the design working load plus 10% of the minimum ultimate transverse load, and held for 2 minutes. The procedure shall be repeated until the load reaches a value of 80% of the minimum ultimate transverse load and thereafter increased in increments of 5% until failure occurs.

Each time the load is applied, it shall be held from two minutes. The column shall be deemed not to have passed the test if the observed ultimate transverse load is less than the design ultimate transverse load.

The factor of safety (FOS) for steel section is 2.0.

7. Bolts and nuts

All bolts, studs, screw threads, bolt heads and nuts shall comply with the appropriate national standards for metric threads, or the technical equivalent. All nuts and pins shall be adequately **locked**.

Head of the bolt in bolt and nut assembly in the horizontal plane must remain in the top. All bolts, nuts shall be treated to prevent corrosion, by hot dip galvanising and washers are to be electro galvanized.

Each bolt or stud shall project minimum three threads through its nut, except when otherwise approved for terminal board studs or relay stems.

8. Galvanising

8.1. General

All machining, drilling, welding, engraving, scribing or other manufacturing activities which would damage the final surface treatment shall be completed before the specified surface treatment is carried out.

8.2. Galvanising

All steel sections including nuts, bolts & washers shall be hot dip galvanised.

9. Labels and plates

All columns shall be clearly labelled indicating, where necessary, its purpose and service positions. The material of all labels and the dimensions, legend, and method of printing / embossing shall be as per approval.

All labels and plates for outdoor use shall be of non corroding material. Where the use of enamelled iron plates is approved, the whole surface including the back and edges, shall be properly covered and resistant to corrosion.

Protective washers of suitable material shall be provided front and back on the securing screws.

Labels shall be engraved in English and local language. Name plates shall be white with black engraved lettering and shall carry all the applicable information specified in the applicable items of the Standards.

Any other relevant information which may be required for groups of smaller items for which this is not possible e.g. switch bays etc. a common name plate in Local language or English with the title and special instructions on it shall be provided.

No scratching, corrections or changes will be allowed on name plates.

TECHNICAL SPECIFICATION FOR 33KV & 11 KV INDUCTIVE VOLTAGE TRANSFORMER

TECHNICAL SPECIFICATION FOR 33 & 11KV INDUCTIVE VOLTAGE TRANSFORMER

1. Scope

The design of Inductive voltage transformers shall be such that its accuracy shall not be affected by the presence of pollution on the external surface of its insulators.

The voltage transformer shall operate satisfactorily in system with high **X/R** ratio.(Tp=100ms) Voltage transformer tanks along with top metallic shall be galvanised and painted to required shade stipulated under relevant sections of the specification.

1.1. This specification provides for the design, manufacture, assembly inspection and testing at the manufacturer's works, packing and delivery FOR [Destination] of outdoor mounted type, single phase, single unit type Inductive voltage transformers for 33kV & 11 kV systems to be used for voltage indication, supply of potential to tariff meters, relays for feeder protection in 33/11 KV Sub-station.

1.2. The IVTs shall be complete in all respects with insulators, bimetallic connectors, fixing details etc. as described herein and Technical Requirement Table I

2. Standards

2.1. The IVTs shall conform in all respects to high standards of Engineering, design, workmanship and latest revisions of relevant standards at the time of offer and the Purchaser shall have the power to reject any work or material which in his judgment is not in full accordance therewith.

2.2. Except to the extent modified in the specifications, the IVTS shall conform to the latest editions and the amendments of the standards listed hereunder but not limited to the following:

Standard Ref. No.		**Title**
IEC-44(4)	:	Instrument Transformer – measurement of PDS.
IEC-60	:	High voltage testing techniques.
IEC-171	:	Insulation co-ordination.
IEC-186	:	Voltage Transformers.
IEC-186(A)	:	Voltage Transformers (first supp. to IEC-186)
IEC-270	:	Partial discharge measurement.
IEC-8263	:	Method for RIV Test on high voltage insulators.

2.3. All the above along with the amendments thereof shall be read and interpreted together.

However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this Technical Specification will prevail.

2.4. The voltage transformers with the requirements of other authoritative standards, which ensure equal or better quality than the standards, mentioned above shall also be acceptable. Where the equipments, offered by the supplier conform to other standards, salient points of difference between the standards shall be brought out in the offer.

3. Climatic and service conditions

Please refer Technical Specification on climatic conditions.

3.1. Earthquake incidence

The VTS are to be designed to withstand earthquake of intensity, equivalent to 0.3g in the horizontal and 0.15g in the vertical direction where, 'g' stands for acceleration due to gravity.

4. Purchaser's auxiliary power supply

4.1. Following power supplies shall be made available at site:

(a) AC-3 phase, 415V, 50HZ earthed.
(b) AC single phase, 240V, 50HZ earthed.±
(c) 220V DC, Ungrounded.

4.2. All equipment and devices shall be capable of continuous satisfactory operation on AC and DC supplies of nominal voltage, mentioned above with variations as given below.

(a) AC voltage variation ± 10%
(b) Frequency variation ± 5%.
(c) Combined voltage & frequency variation ±10%
(d) DC voltage variation 190V to 240V DC.

4.3. The supplier shall make his own arrangements for the power supplies other than those specified under Clause-5.1 above.

5. Installation

The VTS covered under this specification shall be suitable for outdoor installation without any protection from rain, dust, mist and direct rays of the sun.

6. General technical requirements for IVT

6.1. Each IVT shall be supplied, filled with insulating oil and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding filtration and change of oil. In case the tenderer intends to use Nitrogen or any other inert gas above the oil level, the gas must not leak out and the same shall be stated in the tender.

6.2. However, the IVT shall have a provision for draining and filling insulating oil after drying or preferably must have arrangement for drying the oil by continuous process with oil filters.

6.3. The IVT shall be suitable for transport in horizontal position if the transport limitations so demand.

7. Secondary terminal box

7.1. The secondary terminals shall be brought out in a weather proof terminal box with a rating not less than IP-55.

7.2. All secondary terminals shall be brought out in a compartment on one side of each IVT for easy access. The exterior of this terminal box shall be Aluminium extruded sheets.

7.3. The terminal box shall be provided with removable gland plate and glands suitable for 1100 volts grade. PVC insulated, PVC sheathed multi core 4 sq.mm to 6 sq.mm stranded copper conductor cable.

7.4. The terminal box shall be provided with a door in front so as to have easy access of secondary terminals. The door shall have a sealing/locking arrangement and shall be suitable to prevent penetration of moisture and rain water.

7.5. The dimensions of the terminal box and its openings shall be adequate to enable easy access and sufficient working space for use of normal tools.

7.6. The terminal blocks shall be standard type and provided with ferrules indelibly marked or numbered and their identifications shall correspond to the designation on the relevant wiring diagram.

7.7. Secondary wiring terminal studs shall be provided with at least three nuts, plain and spring washers. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. Polarity shall be indelibly marked on each primary and secondary terminal.

7.8. The IVT shall be filled with oil under vacuum after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture from entering the tanks. Oil filling and/or oil sampling cocks, if provided to facilitate factory processing should be properly sealed before despatching the IVT. The method, adopted for hermetic sealing shall be described in the offer.

7.9. The castings of base, collar etc. shall be diecast and tested before assembly to detect cracks and voids, if any.

7.10. The characteristics of the IVTS shall be such as to provide satisfactory performance such as voltage error and phase displacement at rated frequency shall not exceed the values as per relevant standards at any voltage between 80% and 120% of rated voltage and with burdens of between 25% and 100% of rated burden at a power factor of 0.8 lagging. The error shall be determined at the terminals of the IVT and shall include the effects of any fuses or resistors as an integral part of the IVT.

7.11. Inductive voltage transformers shall be designed so as to achieve the minimum risk of explosion in service. The bidder shall bring out in his offer, measures taken to achieve this.

8. Primary winding

Primary winding of the IVT will be connected phase to neutral with the neutral point solidly earthed. The arrangement for this shall be included in the scope of supply. The primary conductor shall be of adequate cross-section so that the maximum permissible current density shall not be exceeded even during short-circuit conditions.

9. Secondary winding

Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. The secondary conductor shall be of adequate cross section so that the maximum permissible current density shall not be exceeded even during short-circuit conditions. Each 33 & 11 KV IVT will have two secondary windings, **protection-20 VA; –Metering-15 VA** – burden at 0.8 lagging power factor and rated voltage of 110V/1.732V for protection and 110 / 1.732V for metering winding. Secondary windings shall be used for metering, relaying and synchronizing. Each winding shall comply requirements of both Part-II and III of latest editions of IEC-186.

10. Core

Core laminations shall be of cold rolled grain oriented silicon steel or other equivalent alloys of low hysteresis and eddy current losses, high permeability to ensure accuracy i.e. 0.2 / 0.5 accuracy class at both normal and high over voltage. The core material, thickness of lamination, the relevant graphs showing the characteristics of the core materials shall be submitted along with the offer.

11. Tank

11.1. Both expansion chambers and tanks of the IVT shall be made of high quality steel and shall be able to withstand full vacuum and pressure, occurring during transit and thermal and mechanical stresses resulting from maximum short circuit current during operation. The tanks along with all ferrous parts shall be hot- dip galvanized as per relevant standard.

11.2. The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. Welding in horizontal plane is to be avoided as welding at this location may give way due to vibrations during transport resulting in oil leakage. Supplier has to obtain specific approval from the purchaser for any horizontal welding, used in the bottom tank

11.3. Paint inside the metallic housing shall be of anti-condensation type.

12. Porcelain housing

12.1. The housing shall be made up of homogeneous, vitreous porcelain of high mechanical and dielectric strength, Glazing of porcelain shall be of uniform brown or dark brown colour with

a smooth surface, arranged to shed away rain water or condensed water particles(fog).The details of location and type of joint, if provided on the porcelain, shall be furnished by the Bidder along with the offer.

12.2. The bushings of the IVTS and hollow porcelain insulators shall conform to latest edition of relevant standards

12.3. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength

12.4. The bushings shall have ample insulation, mechanical strength and rigidity for the condition under which they shall be used and shall be used and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove the internal heat.

12.5. Cast metal and caps for the bushings shall be of high strength hot dip galvanized malleable iron. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionisation.

12.6. The insulation of bushings shall be co-ordinate with that of the IVT such that the flashover, if any, shall occur only external to the IVT.

12.7. Oil level gauge and convenient means of filling, sampling and draining of oil shall be provided.

12.8. End shields should be provided for distribution of stresses.

12.9. Corona shields for bushings, if required, should be provided.

13. Insulating oil

The quantity of insulating oil for the filling and the complete specification of the insulating oil shall comply to latest edition of relevant standards. The IVTS shall be supplied completely filled with purified oil.

14. Prevention of oil leakage and entry of moisture

The supplier shall ensure that the sealing of the IVT is properly achieved. In this connection, the arrangement provided by the supplier at various locations including the following ones shall be described, supported by sectional drawings

(a) Locations of emergence of primary & secondary terminals..
(b) Interface between porcelain housing and metal tank(s).
(c) Cover of the secondary terminal box.

14.1. Nuts and bolts or screws used for fixation of the interfacing porcelain bushings for taking out terminals shall be provided on flanges, cemented to the bushings and not on the porcelain.

14.2. For gasket joints, wherever used, nitrite butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.

15. Fittings and accessories

15.1. Fittings and accessories, listed below shall be supplied with each IVT. Any fitting, required essential other than those listed below shall also be supplied along with each IVT.

(a) Oil level gauge.
(b) Oil filling hole and cap.
(c) Pressure relieving device.
(d) Lifting lugs for core and windings, bushings & complete transformers.
(e) Phase terminal connectors.
(f) Tank earthing pads/terminals with necessary nuts and bolts and washers for connecting to earth strip.
(g) Name/Rating plate.
(h) MCB & H.R.C. fuse

15.2. Oil level gauge:- An oil level gauge shall be provided to indicate the oil level in the IVT. This gauge shall be mounted in such a way that the oil level can be seen from the ground level.

15.3. Pressure relieving device: - Each IVT shall be provided with a pressure relieving device so as to protect bushing of the IVT even under unfavourable conditions.

15.4. Oil drain cock: - An oil drain cock along with a stop cock shall be provided in the bottom flange so as to permit taking of oil samples for testing, if required.

15.5. Earthing:- Metal tank of each IVT shall be provided with two separate earthing terminals for bolted connection to 50mm x 6mm flat to be provided by the Purchaser for connection to station earth-mat.

15.6. Lifting arrangement: - The IVT shall be provided with suitable lifting arrangement to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing. Lifting arrangement [Lifting eye] shall be positioned in such a way so as to avoid any damage to the porcelain housing or the tanks during lifting for installation/transport. Necessary string guides shall be offered which shall be of removable type.

15.7. Name plate: - The IVT shall be provided with non-corrosive legible name plate with the information specified in relevant standards, duly engraved/punched on it.

15.8. Gasket joint: - The manufacturer shall furnish the type of gasket used or setting methods.

15.9. Terminal connectors: - All the IVTS shall be provided with bimetallic solder less clamp type, rigid type terminal connectors, suitable for AAAC conductor. Each terminal connector shall be of universal type, suitable for both horizontal and vertical connections to the transmission line conductors/station bus bar.

15.10. Terminal connectors shall be manufactured and tested as per relevant standards.

15.11. All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

15.12. No part of a clamp shall be less than 10mm thick.

15.13. All ferrous parts shall be hot dip galvanized conforming to relevant standards. For bimetallic connectors, copper alloy linear of minimum thickness of 2 mm shall be cast integral with aluminium body.

15.14. All current carrying parts shall be designed and manufactured to have minimum contact resistance.

15.15. Connectors shall be designed to be corona free in accordance with the requirements, stipulated in relevant standards.

15.16. Secondary wiring

The Secondary wiring shall be enclosed in conduits and shall be brought to a terminal block ready for external connections. The wiring shall be of adequate cross-section and not less than 4.00 sq.mm copper wire.

15.17. The supplier shall supply necessary hardware, required for connection of phase side conductor to the line terminal and the grounding strip to the grounding terminal.

15.18. Necessary nuts and bolts for fixing the IVTS on the supporting structures shall be in tenderer's scope of supply.

16. Tests

16.1. Type tests

The offered 33 & 11 KV Inductive voltage transformer should have been subjected to the following type tests in a Government approved Test Laboratory. The bidder shall furnish the type test reports during detailed Engineering & approval of Drawing. These tests must not have been conducted earlier than five years from the date of opening of the bid. For any change in the design/type already type tested and to the design/type offered against this specification, the purchaser reserves the right to demand repetition of some or all type tests/special tests without any extra cost to CLIENT in the presence of purchaser's representative at the cost of the supplier.

For 33 & 11 KV IVT:

(a) Temperature rise test.
(b) Short circuit withstand capability test.
(c) Lightning Impulse Test.
(d) High Voltage power frequency wet withstand voltage tests.
(e) Determination of errors.
(f) IP-55 Test on secondary Terminal Box.

N.B.:-

i) The dielectric type tests should have been carried out on the same transformer.
ii) After the IVT was subjected to the dielectric tests, it should have been subjected to all routine tests as per relevant standards.
iii) For Temperature Rise Test, the test must have been made with the appropriate rated burden, connected to each secondary winding.

16.2. Routine tests

The following routine tests shall be conducted on each VT in the presence of Purchaser's representative for which no charges will be payable by CLIENT. No sampling is allowed.

(a) Verification of terminal markings.
(b) Power frequency withstand tests on primary windings/capacitor voltage divider for IVT
(c) Partial discharge measurement.
(d) Power frequency withstand tests on secondary windings/Low voltage terminal.
(e) Power frequency withstand tests between sections.
(f) Determination of errors on complete.
(g) Measurement of Insulation resistance.
(h) Oil leakage test.
(i) Measurement of capacitance and dielectric dissipation factor before and after dielectric tests (as per IEC-358)
(j) Any other test as per relevant national & international standards.

N.B.: Determination of errors shall be performed after the other tests. The standard reference VT to be used during testing for determination of ratio error and phase angle error should of 0.05 accuracy class or better as per standard practice, presently adopted by CLIENT.

17. Inspection

17.1. The Purchaser shall have access at all times to the works and all other places of manufacture, where the IVTs are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacturer of all the accessories and for conducting the necessary tests.

17.2. The Supplier shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangement could be made for inspection at the discretion of the Purchaser.

17.3. No material shall be despatched from its manufacture unless the material has been satisfactorily inspected, tested and despatch clearance issued. However, the Purchaser reserves the right to alter the despatch schedule attached to this Specification.

17.4. The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this Specification and shall not prevent subsequent rejection, if such equipments are found to be defective.

17.5. Clear 15 (Fifteen) days notice shall be given to this office for deputing officer(s) for inspection. The Voltage Transformers shall be despatched only after the inspection is conducted by a representative of CLIENT and release order, issued from this office after approval of Routine Test Certificates. The shop routine test certificates in triplicate for all the Voltage Transformers along with the calibration certificates of all the meters and equipments to be used during testing (as per Annexure-B of the Specification) should be furnished along with the Inspection Offer. The Inspecting Officer will be authorised for inspection of the Voltage Transformers subject to the condition that the routine test certificates and calibration certificates of the testing equipments/meters will be found to be in order.

18. Document

The supplier shall furnish four sets of following drawings/documents along with his offer.

(a) General outline and assembly drawings of the Inductive Voltage Transformers
(b) Sectional views showing:

i) General constructional features.
ii) Materials/gaskets/sealing used.
iii) The insulation of the winding arrangements, method of connection of primary/secondary winding to the primary/secondary terminals etc.

(c) Schematic drawing.
(d) Rating & diagram plate as per relevant IEC
(e) Secondary Terminal Box.
(f) Assembly Sectional view of Primary terminal
(g) Assembly drawing for secondary terminal
(h) The detailed dimensional drawing of Porcelain Housing such as ID,OD, thickness and insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.

i) Sectional view of pressure release device.
ii) Drawing showing details of Oil level.

(i) All type test reports relating to the tests as specified in Clause-8.1 of the above.
(j) Ratio and phase angle error curves for IVTS.
(k) Magnetization characteristic curves such as B-H curves and Sp. Loss vs. Flux density curves for core material, used for IVT.

19. Test reports

i) Type test/special test reports shall be furnished to the Purchaser during detailed Engg & approval of drawing.

ii) Copies of acceptance test reports and routine test reports shall be furnished to the Purchaser. One copy will be returned, duly certified by the Purchaser and only thereafter shall the materials be despatched.

iii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the Purchaser.

iv) All test reports of tests, conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when required for by the purchaser.

The necessary galvanized flanges, bolts etc. for the base of the Inductive Voltage Transformers shall be supplied without any extra cost to the purchaser.

20. Packing and forwarding

The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

Table – I
Technical requirements FOR 33 & 11 KV inductive voltage transformers

Description	**11 KV** ± 6%	**33KV IVT** ± 6%
Type	Single phase, 50Hz, oil filled, self cooled, Hermetically sealed, outdoor porcelain type.	Single phase, 50Hz, oil filled, self cooled, Hermetically sealed, outdoor porcelain type.
Nominal system voltage.	11KV. ± 6%	33KV. ± 6%
Highest system voltage.	12 KV	36KV
Frequency.	50Hz, ± 5%	50Hz, ± 5%
System earthing.	Effectively solidly earthed	Effectively solidly earthed
Number of phases.	3 [single phase]	3 [single phase]
(i)Number of secondary windings.	2 (two) (Minimum)	2 (two) (Minimum)
(ii)Purpose of windings.	one protection and one Metering)	one protection and one Metering)
Rated primary voltage.	33/1.732KV	33/1.732KV
Rated secondary voltage.	110/1.732V, (Metering), 110/1.732V, Protection	110/1.732V, (Metering), 110/1.732V, Protection
Ratio	33/1.732KV / 110/1.732V	33/1.732KV / 110/1.732V
Rated burden.	Winding-I(P) - 75VA /3P; Winding-II(M) - 75 VA /0.2 & Simultaneous Burden- 75 VA	Winding-I(P)- 75VA /3P; Winding-II(M)- 75 VA /0.2 & Simultaneous Burden- 75 VA
Accuracy class .	3P/0.2 (Minimum)	3P/0.2 (Minimum)
Rated voltage factor at	1.2 continuous. 1.5 for 30	1.2 continuous. 1.5 for 30

Description	**11 KV** ± 6%	**33KV IVT** ± 6%
rated frequency.	seconds	seconds
Temperature rise at 1.2 times the rated primary voltage, rated frequency & rated burdens.	As per IEC-186 As per IEC-186	As per IEC - 186
Temperature rise at 1.5 times the rated primary voltage for 30 seconds, rated frequency & rated burden.	As per IEC-186	As per IEC - 186
One-minute power frequency dry withstands test voltage for primary winding.	70KV (rms) (Minimum)	70KV (rms) (Minimum)
1-minute power frequency wet withstands test voltage for primary winding.	70KV (rms) (Minimum)	70KV (rms) (Minimum)
1.2/50 micro second impulse withstand test voltage for primary winding	170KV (peak) (Minimum)	170KV (peak) (Minimum)
One-minute power frequency withstands test voltage for Secondary winding Between LV(HF) terminal & earth terminal	3 KV (rms) (Minimum)	3 KV (rms) (Minimum)
Class of insulation.	'A'	'A'
Material of the conductor of primary and secondary windings.	Copper	Copper
Fault level of the bus to which PTs will be connected.	25KA for 1 second (Minimum)	25KA for 1 second. (Minimum)
Minimum creepage distance.	500mm	900mm
Quality of oil.	EHV Grade - As per relevant standards	EHV Grade - As per relevant standards
Radio interference voltage at 1.1 times maximum rated voltage	-	-

Description	**11 KV** ± 6%	**33KV IVT** ± 6%
at 1.0 MHZ.		
Partial discharge level. Seismic acceleration - Horizontal – Vertical.	 0.3g. 0.15g.	 0.3g. 0.15g.
Accuracy class of standard V.T. to be used during testing towards determination of ratio errors and phase angle errors for metering windings.	0.05 or better.	0.05 or better.
Capacitance (Pf)	-	-

TECHNICAL SPECIFICATION FOR 33 KV & 11 KV ISOLATOR

TECHNICAL SPECIFICATION FOR 33 KV & 11 KV ISOLATOR

1.0 SCOPE

This specification provides for design, manufacturer, testing at manufacturer's Works and delivery ,supervision of erection, commissioning of outdoor station type 33kV & 11kV, 3 phase triple pole double break gang operated centre rotating type (Single Isolator with / without earth switches, with electrical interlock (castle key), insulators and complete in all respect with bimetallic connectors arcing horns operating mechanism, auxiliary switches, indicating devices, fixing detail etc. as described hereinafter. Double Tandem operating GI pipes (40mm Dia. medium gauge) & down pipe of 50mm dia, medium gauge GI pipe has to be used.

The material offered shall be procured from short listed vendor at **E-23** and shall have been successfully Type Tested during last five years on the date of bid opening. The Type Test reports shall be submitted along with the bid.

1.1 Main features

Description	33 kV	11 kV
Main switch service	Double end break Centre post rotating, gang operated Outdoor	
Applicable standard	IEC-129 / IEC-62271-102	
Pole (minimum)	3 pole gang operator	
Rated voltage nominal/	33 kV ±6 %	11kV ±6 %
Maximum	36 kV	12 kV
Rated Frequency	50 Hz + 5%	
System earthing	Effectively earthed	
Temperature rise	As per relevant IEC publication	
Insulation level	195 kVpeak	85 kVpeak
impulse with stand voltage (minimum) a) Across Isolating distance b) To earth & between poles	170 kVpeak 80 kVpeak	75 kVpeak 32 kVpeak
1 minute power frequency with stand voltage (minimum) a) Across Isolating distance b) To earth & between poles	80 kVpeak 70 kVpeak	32 kVpeak 28 kVpeak
Rated current in Amp (minimum)	1250	800
Short time current for 3 sec (minimum)	25kA	25kA
Operating mechanism	motorised	Motorised
Auxiliary voltage a) Control & Inter lock	230/ 415 V, AC, / 48 DC	230/ 415 V, AC, / 48 DC
Safe duration of overload a)150% of rated current b)120% of rated current	5 minute 30 minute	5 minute 30 minute
Minimum creepage distance of support and Rotating insulator	900mm	500mm

Description	33 kV	11 kV
i) Mounting structure	Upright on G.I structure	Upright on G.I structure
ii) Terminal connector type	Bimetallic clamp size as per requirements	Bimetallic clamp size as per requirements
iii) Control	Remote	Remote

IMPORTANT NOTE: The operating mechanism for 33kV main switch of isolator shall be motorized operation but 11 kV main switch and both 33 kV & 11 kV earth switch shall be manual operated.

2.0 STANDARDS

Disconnecting switches covered by this specification shall conform to latest edition IEC-129/IEC 62271-102 unless specifically stated otherwise in this specification.

3.0 TYPE

The 33kV & 11kV Isolators shall be outdoor type with three phase double break centre rotating type [Single Isolator(SI) with/without E/S] Isolators suitable for manual / electrical (motorized) operation at Remote/ local end. They shall have crank and reduction gear mechanism.

All Isolators offered shall be suitable for horizontal upright mounting on steel structures. Each pole unit of the multiple Isolators shall be of identical construction and mechanically linked for gang operation.

Each pole of the Isolator shall be provided with two sets of contacts to be operated in series and the moving contact blades shall rotate in horizontal plane.

The design shall be such that the operating mechanism with the linkages shall be suitable for mounting on any of the outer pole ends without much difficulty and with minimum shifting of parts.

Moving contacts of all isolators shall rotate through 90 deg from their “fully closed position” to “fully open position so that the break is distinct and clearly visible from ground level.

The **33kV & 11kV** Isolators offered by the Bidder shall be designed for Normal rating current for **1250 amp.** It should be suitable for continuous service at the system voltages specified herein.

The Isolators shall be suitable to carry the rated current continuously and full short circuit current of 25kA for 33kV & 11kV respectively for 3 second at site condition without any appreciable rise in temperature. These shall also be suitable for operation at 110% rated (normal) voltage. The Isolators shall be suitable for Isolating low capacitive / inductive currents of 0.7amp at 0.15 power factor. The isolators shall be so constructed that they don’t open under the influence of short circuit conditions.

The Isolators and earthing switches are required to be used on electrically exposed installation and this should be taken into account while fixing the clearance between phases and between phase and earth.

4.0 MAIN CONTACTS & MOVING ARM

All Isolators shall have heavy duty, self aligning and high pressure line type contacts made of high conductivity, corrosion resistant, hard-drawn electrolytic copper strips with 5 mm minimum thickness and proper contact area. Also current density to be assured @1 mm^2 = 1.5 Amp. Fixed contact should consist of loops of above copper strips suitable for 1250 Amps ratings for 33kV & 11kV Isolators. The hard dawn electrolytic copper strips should be silver plated 10 micron thickness or more as per the requirement and fixed contacts should be backed by powerful phosphor bronze/stainless steel springs of suitable numbers.

However, the thickness and contact area of the contact should conform to the drawing approved during type test.

These fixed and moving contacts shall be able to carry the rated current continuously and the maximum fault current of 25kA for 33kV & 11kV for 3 seconds without any appreciable rise in temperature. The Isolator blades shall retain their form and straightness under all conditions of operation including all mechanical stress arising out of operation as well as under rated short circuit condition.

Fixed guides shall be provided so that even when the blades are out of alignment by one inch (maximum), closing of the switches, proper seating of the blades in between contacts and adequate pressure to give enough contact surface is ensured. Wherever possible, the blades shall be counter balanced by weights and springs. The contact shall be self cleaning by the wiping action created by the movements of the blades. The surface of the contacts shall be tendered smooth and silver plated.

The Isolator shall be self cleaning type so that when isolator remain closed for long periods in a heavily polluted atmosphere, binding does not occur. No undue wear or scuffing shall be evident during the mechanical endurance tests, contacts and springs shall be designed so that adjustment of contact pressure shall not be necessary throughout the life of the isolator. Each contact or part of contacts shall be independently sprung so that full pressure is maintained on all contact at all times.

5.0 ARCING HORN AND GRADING HORN

Suitable arcing horn made of tinned electrolytic copper which are required for guiding contacts shall be provided on the fixed and moving contacts of all Isolators. The contacts shall be of ‘make before and break after” type.

6.0 ELECTRICAL INTERLOCK / MECHANICAL INTERLOCK

The disconnecting switches whenever required shall be with an approved type electrical interlock for interlocking with the associated circuit breakers and earth switch. Electrical interlock assembly should be more right in construction and properly mounted to ensure reliable operation. The design should be such that the electrical circuit for the interlocking mechanism will only remain energised during operation of the switches.

7.0 AUXILIARY SWITCHES

All isolators and earthing switches shall be provided with 110V DC auxiliary switches for their remote position indication on the control board and for electrical interlocking with other equipment. The auxiliary switch shall be provided with a minimum of auxiliary contacts normally 4 open and normally 4closed contacts with 10 amp. Current carrying capacity.

8.0 EARTH SWITCH

Line earth switch shall consist of three earthing blades for Isolator which normally rest against the frame when the connected Isolator is in closed position. The earthing blades for three phase shall be mechanically linked to a coupling shaft which shall be capable of being fitted on either side of the Isolator. The earthing blades shall match and be similar to the main switch blades and shall be provided at the hinge; with suitable flexible conductors with terminal lugs for connecting to the station ground bus.

The earthing blades shall be operated by a separate mechanism but shall be mechanically interlocked with the main switch so that the earthing blades can be closed only when the main switches are in open position and vice-versa. The earthing blades shall be gang operated and all the three blades will operate simultaneously.

9.0 OPERATING MACHANISM

The operating mechanism shall be simple and shall ensure quick and effective 1000 operation. The design shall be such as to enable one man to operate it with nominal effort. The operating mechanism box shall be made out of Aluminium extruded (Aluminium Alloy) sections of minimum 3mm thickness.

The Isolator blades shall be in positive continuous control throughout the entire cycles of operation. The operating rods and pipes shall be rigid enough to maintain positive control under most adverse conditions and to withstand all torsional and bending stresses arising from operation. Operation of the switches at any speed should not result in improper functioning, in displacement of parts / machines after final adjustment has been made. All holes in cranks, linkages etc. having moving pins shall be drilled and fitted accurately so as to prevent slackness and lost motion.

Provision shall be made for padlocking the operating mechanism of disconnecting and earth switches in both open and closed positions.

Bearings shall be ball and roller type shall be protected from weather and dust by means of cover and grease retainers. Bearings pressures shall be kept low to ensure long life and care of operation.

Each operated isolator shall be driven as well as manually operated and shall be complete with local selector switch and open / close push buttons. The function of all control facilitates operating isolators.

10.0 DESIGN, MATERIALS AND WORKMANSHIP

The live parts shall be designed to eliminate sharp points, edges and similar corona producing surfaces, where this is impracticable, adequate shields to be provided. All ferrous metal parts shall be hot dip galvanized, as per relevant standards. All metal parts shall be of such materials or treated in such a way so as to avoid rust, corrosion and deterioration due to continued exposure to atmosphere and rain. All current carrying parts shall be made from high conductivity electrolytic Copper.

Bolts, screws and pins shall be provided with standard locking device viz. Locknuts, spring washers, keys etc. and when used with current carrying parts, they shall be made of copper silicon or other high conductivity and wear resistant alloys.

The switches should not need lubrication o7f any parts except at very long interval of five year minimum.

11.0 PROTECTIVE COATINGS

All ferrous parts including bolts, nuts and washers of the switches assembly shall be galvanized to withstand at least six times one minute dips in Copper Sulphate solution of requisite strength (Pierce tests) except the threaded portions which should withstand four dips.

12.0 INSULATORS

Support insulators for all type of isolators shall be of solid core type. The insulator shall be made of homogeneous and vitreous porcelain of high mechanical and dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit forces etc. Glazing of the porcelains shall be of uniform dark brown colour with a smooth surface arranged to shed away raise water.

The porcelain shall be free from laminations and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture. The porcelain and metal ports shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create under internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings.

The insulator shall be suitable for water washing by rain or artificial means in service condition. Profile of the insulator shall also conform to IEC-815. Insulator shall have a minimum cantilever strength of 800 kgs. Caps to be provided on top of the insulator shall be of high grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanized. The cap shall have four numbers of tapped holes spaced on a pitch circle diameter of 76 mm. The holes shall be suitable for bolts with threads having anti corrosive protection.

The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona and shall have radio interference level within 500 micro volts. Casing shall be free from blow holes cracks and such other defects.

13.0 CONTROL CABINET:

The control cabinet of the operating mechanism shall be made out of Aluminium sheet of minimum **3mm** thickness. Hinged door shall be provided with pad locking arrangement. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type of gaskets shall be provided to ensure degree of protections of at least IP 55.

The cabinet shall be suitable for mounting on support structure/or on a separate plinth foundation with adjustment for vertical, horizontal and longitudinal alignment. Details of these arrangements shall be furnished along with the offer.

14.0 Gear :

The Disconnector / Isolator may be required to operate occasionally, with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet this requirement. The gear shall be made out of Aluminium bronze or any other better material lubricated for life with graphite or better quality non-drawing and non-hardening type grease. Wherever necessary automatic relieving mechanism shall be provided suitable relay, Device shall be provided to prevent over loading of the motor.

Single phase preventer (for 3 phase motor) shall be provided to operate on open circuiting of any phase and shall trip off the motor. Complete details of the devices shall be furnished in the offer.

15.0 Terminal block and Wirings –

Each operating mechanism shall be provided with 1100V grade stud type terminal block of polyamide material of approved make.

All auxiliary switches, interlocks and other terminals shall be wired up to terminal block.

The terminal block shall have at least 20% extra terminals. All wiring shall be carried out with 1.1KV grade insulated 2.5 sq mm copper wires.

A. Position indicator:

A position indicator to show the isolator is in ON or OFF position to be provided.

B. Name plate:

Isolator, earthing switches and their operating devices shall be provided with name plate. The name plate shall be weather proof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following information's duly engraved or punched on it.

C. Isolator Base

Name of manufacturer –
Order No. –
Type Designation –
Manufacturers serial No. –
Rated voltage –
Rated normal current –
Rated short time current (rms) and duration –
Rated short time peak current (kApeak)
Weight

D. Earthing Switch

Name of manufacturer –
Order No. –
Type Designation –
Manufacturers serial No. –
Rated voltage –
Rated normal current –
Rated short time current (rms) and duration
Rated short time peak current (kApeak)
Weight

E. Operating Device

Name of manufacturer –
Order No.
Type Designation –
Reduction gear ratio –
AC motor
1) Rated auxiliary voltage
2) Starting current
3) Designation of AC motor as per I.S 4722/325
4) Starting torque at 80% of supply voltage
5) Over travel in degrees after cutting off supply
Total operating time in seconds
6) Close operation – Electrical
7) Open operation – Electrical
8) Open operation – Manual

All components shall be given adequate treatment of climate proofing as per Relevant standards, so as to withstand corrosive and severe service conditions. All metal parts not suitable for painting such as structural steel, pipes, rods, levers, linkages, nuts and bolts used in other than current path etc. shall be hot dip galvanized as per relevant standards.

Complete details of painting, galvanizing and climate proofing of the equipment shall be furnished in the offer.

16.0 TESTS

16.1 Type Tests

Isolators offered, shall be fully type tested as per the relevant standards. The Bidder shall furnish three sets of the following valid type test reports for their different type of offered Isolators along with the offer. The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative. For this purpose the Bidder may quote unit rates for carrying out each type test and this will be taken during bid price evaluation, if required.

a) Short time withstand & peak withstand current test for Isolator & Earth Switch.
b) Power frequency (Dry & Wet),Lightening Impulse dry withstand Test
c) Mechanical endurance Test
d) IP-55 test

During type tests the isolator shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure and mounting arrangements shall be furnished for Purchaser's approval before conducting the type tests.

The type tests shall be conducted on the isolator along with approved insulators and terminal connectors.

Mechanical endurance test shall be conducted on the main switch as well as earth switch of one isolator of each type

16.2 Acceptance and Routine Test:

All acceptance and routine test as stipulated in the relevant standards shall be carried out by the supplier in presence of Purchaser's representative.

Mechanical operation test (routine test) shall be conducted on isolator (main switch and earth switch) at the supplier's works as well as purchaser's substation site.

Immediately after finalisation of the programme of type / acceptance, routine testing the supplier shall give sufficient advance intimation (clear 20 days advance intimation), along with shop routine test certificates, valid calibration reports from Govt. approved test house for the equipments, instruments to be used during testing for scrutiny by the purchaser to enable him to depute his representative for witnessing the tests. If there will be any discrepancies in the shop routine test certificates and calibration reports furnished by the firm then after settlement of the discrepancies only, purchaser's representative will be deputed for witnessing the tests.

These special type test charges shall be quoted along with all other type tests as per relevant IEC standard and these charges shall be included in the total bid price.

Test certificates of various items including but not limited to the following shall be furnished at the time of routine tests.

i. Chemical analysis of copper along with a copy of excise certificate indicating genuine source of procurement of electrolytic grade copper.
ii Bearings
iii Fasteners
iv Universal / swivel joint coupling
v Insulators
vi Gears
vii Auxiliary switch
viii Overload / single phase preventer relay
ix Interlocking devices
x Terminal block
xi Any other item

17.0 INSPECTION

i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the dis-connectors, earth switches and associated equipment are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the

works raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii) The supplier shall keep the purchaser informed in advance of the time of starting of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.

iii) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

iv) The acceptance of any quantity of the equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.

18.0 DOCUMENTATION

All drawings shall conform to relevant international standards organization (ISO). All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

List of Drawings and Documents

The Bidder shall furnish four sets of following drawings / documents along with his offer.

a) General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector.

b) Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides, swivel joint operating mechanism and its components etc.

c) Loading diagram

d) Drawings with structure for the purpose of type tests.

e) Name plate.

f) Schematic drawing.

g) Type test reports.

h) Test reports, literature, pamphlets of the bought out items and raw material.

The contractor should submit two sets of final versions of all the above said drawings for Purchaser's approval. The purchaser shall communicate his comments / approval on the drawings. The supplier shall, if necessary, modify the drawings and resubmit the modified drawings for Purchaser's approval within two weeks from the date of comments. After receipt of approval the supplier shall within three weeks submit 15 prints and two good qualities reproducible of the approved drawings for purchaser's use.

Six sets of the type test reports, duly signed by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply Adequate copies of acceptance and routine test certificates, duly approved by the Purchaser shall accompany the despatched consignment.

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. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier risk.

19.0 INSTRUCTION MANUALS:

Fifteen copies of the erection, operation and maintenance manuals in English be supplied for each type of disconnector one month prior to dispatch of the equipment. The manual shall be bound volumes and shall contain all drawings and information required for erection, operation and maintenance of the disconnector including but not limited to the following particulars.

(a) Marked erection prints identifying the component parts of the disconnect or as shipped with assembly drawings.

(b) Detailed dimensions and description of all auxiliaries.

(c) Detailed views of the insulator stacks, metallic, operating mechanism, structure, interlocks, spare parts etc.

TECHNICAL SPECIFICATION FOR SURGE ARRESTERS

TECHNICAL SPECIFICATION FOR SURGE ARRESTERS

1.0 SCOPE

This Specification provides for the design, manufacture, inspection and testing before dispatch, packing and delivery F.O.R. (destination) of **Metal Oxide** (**gapless**) Surge Arresters with discharge counters, insulating base, terminal connectors and other accessories as specified here in.

Following is the list of documents constituting this Specification:

(i) Technical Specification (TS)
(ii) Check-List. Annexure-B
(iii) Calibration Status of testing equipments and meters/ Instruments. Annexure-C
(iv) Check-list towards Type Test Reports. Annexure-D

Note : Annexure-B,C,& D are to be filled up by the Bidder.

All the above along with amendments thereof shall be read and interpreted together.

However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this volume will prevail.

The Surge Arrester shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or materials, which in his judgement is not in full accordance therewith.

2.0 STANDARDS:-

2.1 Except to the extent modified in the Specification, the Surge Arrester shall conform to the latest editions and amendments of the standards listed hereunder.

Standard Ref. No.	Title
IEC-99-4	Specification for Surge Arresters without gap for AC System
IEC-621155	Specification for large hollow porcelain for use in electrical installation
IEC-60-1	High-Voltage Test technique
IEC-270	Partial discharge measurements.
IEC-99-1	Non-linear resistor type gapped arresters for a.c. systems.
IEC-60815	Shed profile of hollow porcelain Insulator.

2.2 Surge Arresters which ensure equal or better quality than the standards, mentioned above shall also be acceptable. Where the equipment offered by the supplier conforms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer.

3.0 GENERAL TECHNICAL REQUIREMENTS:

The Surge Arrester shall confirm the technical requirements The energy handling capability of each rating of Arrester offered, supported by calculations, shall be furnished with the offer.

The Surge Arresters shall be fitted with pressure relief devices and arc diverting paths and shall be tested as per the requirements of IEC for minimum prospective symmetrical fault current as specified in Appendix-I.

A grading ring shall be provided if required, (for attaining all the relevant technical parameters) on each complete Surge Arrester.

4.0 PROTECTIVE LEVELS :

Surge Arresters shall be capable of providing protection to sub-station equipments, designed for the withstand levels, given in the following table.

	Insulation Level of 36KV System	**Insulation Level 12KV System**
	BIL (kVpeak)	**BIL (kVpeak)**
Equipment to be protected	36KV System	of 12KV System
Power Transformers.	BIL (kVpeak)	BIL (kVpeak)
Instrument Transformers.	170 (minimum)	78 (minimum)
Reactors	170 (minimum)	78 (minimum)
Circuit Breakers/Isolators.	170 (minimum)	78 (minimum)

Surge arrester shall be suitable for the following duty cycles of circuit breaker at the following system voltages:

36 kV Circuit Breaker : O-0.3 sec-CO-3 min-CO
12 kV Circuit Breaker : O-0.3 sec-CO-3 min-CO

5.0 DUTY REQUIREMENT:

Surge Arresters shall be of heavy-duty station class and gapless type without any series or shunt gaps.

i. Surge Arresters shall be capable of discharging over voltages occurring during switching of un-loaded transformers, lines, capacitors and reactors.
ii. The Surge Arresters shall be capable of discharging lightning and switching surges and temporary power frequency over-voltages.
iii. The Surge Arresters shall be capable of discharging the energy equivalent to class 3 of IEC-99-4.

The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage. The supplier shall submit values and the supporting evidence along with calculations on above. Surge Arresters shall be fully stabilized thermally to give a life expectancy as per standard under site conditions. Surge Arresters shall be able to withstand maximum wind load of 260 Kg./sq.m. Surge Arresters shall be capable of withstanding effects of direct solar radiation.

Surge arresters shall be capable of spark over on severe switching Surges and multiple strokes.

The Surge Arrester should be adequately designed to operate satisfactorily under temporary power frequency over-voltage as given in specific technical requirements, after discharging two shots of respective long duration surges.

Unless otherwise brought out separately by the Bidder in the schedule of deviations, the Surge Arresters, offered shall conform to the specification scrupulously. All deviations from the specification shall be brought out in the schedule of deviations.

The discrepancies between the specification and the catalogues or literature, submitted as part of the offer shall not be considered as valid deviations unless specifically brought out in the schedule of deviations.

6.0 CONSTRUCTION:

Non linear blocks shall be sintered metal oxide material. These shall be provided in such a way as to obtain robust construction with excellent electrical and mechanical properties even after repeated operations. All the units of arresters of same rating shall be inter-changeable without adversely affecting the performance. The Surge Arresters shall be suitable for pedestal type mounting. All the necessary flanges, bolts, nuts, clamps etc. required for assembly of complete arrester with accessories and mounting on support structure to be supplied by the Contractor.

The drilling details for mounting the Arrester on CLIENT support shall be supplied by the CLIENT.

The minimum permissible separation between the Surge Arrester and any earthed object shall be indicated by the Bidder in his offer. Surge Arresters shall be designed to incorporate pressure relief devices and arc diverting paths to prevent shattering of the blocks or the porcelain housing, following prolonged current flow or internal flash over and providing path for flow of rated fault currents in the event of arrester failure.

Surge Arresters shall incorporate anti-contamination feature to prevent arrester failure, caused by uneven voltage gradient across the stack, resulting from contamination of the arrester porcelain. Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.

The heat treatment cycle details along with necessary quality checks used for individual blocks along with insulation layer, formed across each block are to be furnished.

Metalized coating thickness for reduced resistance between adjacent discs is to be furnished along with the procedure for checking the same. Details of thermal stability test for current distribution of current on individual disc is to be furnished.

Each individual unit of Surge Arresters shall be hermetically sealed and fully protected against ingress of moisture. The hermetic seal shall be effective for the entire lifetime of the arrester and under the service conditions as specified. The supplier shall furnish sectional view of the arrester showing details of sealing employed. The Surge Arresters shall be suitable for hot line washing.

7.0 PORCELAIN HOUSING :

All porcelain Housings shall be free from lamination cavities or other flaws, affecting the maximum level of mechanical and electrical strengths. The porcelain shall be well vitrified and non-porous. The minimum creepage distance of the arrester housing shall be as per Cl 7.21 of the TS.

The porcelain petticoat shall be preferably of self-cleaning type (Aerofoil design). The details of the porcelain housing such as height, angle of inclination, shape of petticoats, gap between the petticoats, diameter (ID and OD) etc. shall be indicated by the Bidder in his offer in the form of detailed drawing. Porcelain housings shall be so coordinated that external flash over will not occur due to application of impulse or switching Surge voltages up to the maximum design value for arrester.

8.0 GALVANISATION, NICKEL PLATING ETC.

All ferrous parts exposed to atmosphere shall be hot dip galvanized as relevant standards, as amended from time to time. **Tinned copper/brass lugs shall be used for internal wiring of discharge counter**. Screws used for electrical connections shall be either made of brass or shall be nickel-plated. Ground terminal pads and nameplate brackets shall be hot dip galvanized. The material shall be galvanized only after completing all shop operations

9.0 ACCESSORIES AND FITTINGS

9.1 Surge Counters

A self- contained Surge counter, suitably enclosed for outdoor use and requiring no auxiliary of battery supply for operation shall be provided for each unit. The surge counter shall be operated by the discharge current, passed by the surge arrester and shall be suitable for mounting on the support structure of the Arrester.

Surge counters shall be of the Electro-mechanical type and designed for continuous service. The cyclometer counter shall be visible through an inspection window from ground level. The counter terminals shall be robust and adequate size and shall be so located that the incoming and outgoing connections are made with minimum possible bends. Internal parts shall be unaffected by atmospheric conditions at site.

Alternatively, a weather proof housing to IP 55 shall be provided and this shall be designed to allow the recording device to be read from ground level without exposing the internal parts to the atmosphere.

The Surge Counter shall be connected in the main earth lead from the arrester in such a manner that the direction of the earth lead is not changed or its surge impedance materially altered. A bolted link shall be provided so that the surge counter may be short circuited and removed without taking the arrester out of service**.** All necessary accessories and earthing connection leads between the bottom of the Arrester and discharge counter shall be in the Contractor's scope of supply.

10.0 LEAKAGE CURRENT METERS: (In case of 33 kV Surge Arrester only) Leakage current meters (suitable milli-ammeter) shall be connected in the earthing path of the surge

arresters to measure the resistor grading leakage current. Meters shall be designed for continuous service.

The ammeter shall be suitable for mounting on the support structure of the arrester.

The push buttons shall be mounted such that it can be operated from the ground level.

The internal parts shall be fully weather - proof to IP 55 or better with a transparent cover to provide an unobstructed view of the ammeter. Arresters shall be complete with insulating base having provision for bolting to flat surface of the structure.

The grounding terminals shall be suitable for accommodating grounding connection to steel earth mat.

Clamp type terminal connector, suitable for AAAC conductor of suitable size shall be provided having both horizontal and vertical take-off. Two clamp type ground terminal connectors, suitable for G. I. Strip (50 x 6) should be provided.

All interconnecting hardwares such as nuts, bolts, spring washers etc. with 5% spares] shall be supplied for different units. Pollution Shunt (Copper braid) shall be supplied along with each Surge Arrester for by-passing the surface current. Other standard accessories, which are specifically not mentioned, but are usually provided with Surge Arrester of such type and rating for efficient and trouble free operation should be supplied.

11.0 NAME PLATE :

Each single pole Arrester shall be provided with non-corrosive legible name plate, at the base bearing thereon, voltage rating of the complete pole and the number of demountable sections with the following data, indelibly marked

(a) Name of the CLIENT
(b) Purchase order No. & Date.
(c) Name of device.
(d) Manufacturer's name and trademark and identification no. of the arrester being supplied.
(e) Year of manufacture
(f) Rated voltage
(g) Rated Frequency
(h) Maximum continuous operating voltage.
(i) Type
(j) Nominal discharge current.
(k) Long duration discharge class.
(l) Pressure relief current in KA(rms)
(m) Energy discharge capability (KJ / KV rating).

12.0 TEST:

12.1 Type Tests:

The surge Arrester offered should have been subjected to the following **Type tests** in an independent Government approved test laboratory. The bidder shall furnish four sets of type

test reports along with the drawings for approval. These tests must not have been conducted earlier than five years from the date of opening of technical bid.

For any change in the design type, already type tested and the design type offered against this specification, the purchaser reserves the right to demand repetition of some or all type tests without any extra cost and in presence of Purchaser's representative at the cost of the Contractor.

1. Insulation withstands tests :
   (a) Lightning Impulse Voltage Test.
2. Residual voltage tests.
3. Long duration current impulse withstand tests.
4. Operating duty tests.
5. Pressure relief tests.
   (a) High current test.
   (b) Low current test.
6. Power frequency voltage vs. time curve.
   (Temporary over voltage test)
7. Contamination test. (artificial pollution test).
8. Seismic withstand test.
9. IP-55 test on surge counter.
10. Minimum current operation tests of the surge counter.
11. Maximum current withstand test of the surge counter.
12. Mechanical terminal load test on bushing.
13. Partial discharge test.

N.B. :-Even if the condition i.e. the dry arcing distance or the sum of the partial dry arcing distances is larger than the test voltage divided by 500 KV/m', the lightning impulse voltage test must have been conducted or is to be conducted without any financial liability to CLIENT.

12.2 ROUTINE TESTS :

The following **Routine tests** shall be conducted at the supplier's cost on each Surge Arrester and shall be submitted along with or before offering for inspection for purchaser's approval.

(a) Measurement of reference voltage.
(b) Residual voltage tests.
(c) Measurement for partial discharge and contact noise.
(d) Sealing test for units with sealed housings.

12.3 ACCEPTANCE TESTS :

The following tests, considered as **Acceptance tests**, shall be conducted in the presence of purchasers representative for which no charges will be payable by purchaser. The acceptance tests, whenever possible shall be conducted on the complete arrester unit. The number of samples to be subjected to acceptance test shall be decided by the purchaser at the time of actual testing.

I Temperature Cycle Test on Housing.
II Measurement of Power Frequency Voltage at the reference current.

III Measurement of leakage current and capacitive current at M.C.O.V.
IV Lightning Impulse Residual Voltage Test at N.D.C., 50% of N.D.C. & 200% of N.D.C.
V Partial Discharge Tests on complete arresters/units at 1.05 times M.C.O.V.
VI Special Thermal stability test.
VII Porosity test on porcelain components.
VIII Galvanization test on metal parts.
IX The functional (operational) test on the Surge Counter by way of checking its operation at following nominal discharge currents :
a) 100 Amps with 8/20 micro second wave shape.
b) 10 KA with 8/20 micro second wave shape.
X Check of calibration of leakage current meters.

13.0 INSPECTION :

I The purchaser shall have access at all time to the works and all other places of manufacture, where the Surge Arresters are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacture of all the accessories and for conducting the necessary tests.

II The supplier shall keep the purchaser informed in advance of the time of starting and the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.

III No material shall be despatched from its point of manufacture unless the material has been satisfactorily inspected, tested and despatch schedule attached to this specification.

IV The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are later found to be defective.

14.0 DOCUMENTATION:

All drawings shall conform to relevant Indian Standard as per relevant standards. All drawings shall be in ink and suitable for microfilming. All dimensions and data shall be in S.I. Units. The supplier shall furnish two sets of following drawings / documents along with his offer.

I. General outline drawings of the complete Arrester with technical parameters.
II. Drawings showing clearance from grounded and other line objects and between adjacent poles of Surge Arresters, required at various heights of Surge Arresters.
III. Drawings showing details of pressure relief devices.
IV. Detailed drawing of discharge counters along with the wiring and schematic drawing of discharge counter and meter.
V. Outline drawing of insulating base.
VI. Details of grading rings, if used.
VII. Mounting details of Surge Arresters.
VIII. Details of line terminal and ground terminals.
IX. Volt-time characteristics of Surge Arresters.
X. Details of galvanization being provided on different ferrous parts.

XI. The detailed dimensional drawing of porcelain Housing such as ID, OD, thickness and insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.

XII. Cross-sectional view of the Surge Arrester Units showing all components.

15.0 TEST REPORTS :

(i) Three copies of type test reports shall be furnished to the purchaser with the tender specification. Copies of acceptance test reports and routine test reports shall be furnished to the purchaser. One copy will be returned duly certified by the purchaser and only thereafter shall the materials be despatched.

(ii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the purchaser.

(iii) All test reports of tests, conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when requested for by the purchaser.

TECHNICAL REQUIREMENTS FOR METAL OXIDE (GAPLESS) SURGE ARRESTERS

Technical Parameters for Surge Arrestors

Sl. No.	Particulars	Technical Parameters for Surge Arrestors	
		30 kV	**10 kV**
1	Nominal system voltage (phase to phase) (KV rms).	33 ± 6%	11 ± 6%
2	Highest system voltage (phase to phase) (KV rms).	36	12
3	System Frequency (HZ).	50 ±5%	
4	System Neutral earthing.	Effectively earthed	
5	Installation.	Outdoor	
6	Class.	Station class, 10 KA, heavy duty type.	
7	Type of construction for 10 KA rated arrester.	Single column, single phase	
8	No. of phases. (minimum)	Three	
9	Maximum duration of earth fault (Sec.)	3	
10	Maximum prospective symmetrical fault current at arrester location (KA rms.)	40	
11	Rated arrester voltage (KV rms)	30	9
12	Nominal discharge current (KAP) (minimum) Discharge current at which insulation co-ordination will be done	10 KA of 8/20 µsec Wave.	
13	Minimum energy discharge capability (KJ/KV)	As per relevant IEC	
14	Maximum continuous operating voltage at 50º C (KV rms)	25	9.6
15	Maximum switching surge residual voltage (KVP)	72 at 500A	28
16	Maximum residual voltage at 8/20 micro second(KVP)		
	(i) 5 KA.	85	32
	(ii) 10 KA Nominal discharge current.	90	35

Sl. No.	Particulars	Technical Parameters for Surge Arrestors	
		30 kV	**10 kV**
	(iii) 20 KA.	100	40
17	Long duration discharge class	2	2
18	High current short duration test value (KAP) (4/10 Micro-second wave).	100	100
19	Current for pressure relief test (KA-rms) (minimum)	40	40
20	Minimum total creepage distance (mm).	900	380
21	One minute dry and wet power frequency withstand voltage of Arrester housing (KV-rms).	70	28
22 (a) b)	Impulse withstand voltage of Arrester housing with 1.2/ 50 micro-second wave (KVP). Switching Impulse Voltage (Wet) (KVP)	110.5 -	41.6 -
23	Pressure relief class.	A	A
24	Corona extinction voltage (KV-rms).	-	-
25	RIV at 92 KV rms.	Less than 500 micro volts	Less than 500 micro volts
26	Partial discharge at 1.05 times continuous over-voltage.	Nor more than 50 PC	Nor more than 50 PC
27	Seismic acceleration.	0.3g horizontal 0.15g vertical	0.3g horizontal 0.15g vertical
28	Reference ambient temperature.	50ºC	50ºC
29	(a) IR at MCOV.	Less than 400 micro amperes	Less than 400 micro amperes
	(b) IC at MCOV.	Less than 1200 micro amperes	Less than 1200 micro amperes
30	a) Reference Current (mA)	1 to 5 mA	
	b) Reference voltage at reference current.	Greater than rated voltage.	
31	Maximum steep current Impulse RDV (KVP). at KAP	100	
32	Maximum cantilever strength of the arresters (KGM).	325	325
33	TOV(KVP). (minimum)		
	(i) 0.1 sec.	53	20
	(ii) 1.0 sec.	51	18
	(iii) 10.0 sec.	49	16
	(iv) 100.0 sec.	47	14

ANNEXURE – B

CHECK – LIST

1. Whether calculation towards energy handling capability of the Surge Arrester furnished?

2. Whether the heat treatment cycle details along with necessary quality checks used for individual blocks furnished?

3. Whether sectional view of arrester furnished showing details of sealing provided?

4. Whether porcelain petticoat is of Aero foil design? Whether drawing of porcelain

5. Housing as per Clause No.7.9 of TS furnished?

6. Whether drawings and documents as per TS furnished?

7. Whether special measures in the manufacture of Surge Arrester for operating at ambient temperature of 50ºC (against 40 ºC as per IEC-99-4, Clause No.4.4.1) are to be taken? …….. State the special measures in details ……..

ANNEXURE – C

CALIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS/METERS

Name of the test	Meters and equipments require for the corresponding test with range accuracy make and Sl. No.	Date of Calibration.	Due date of Calibration.	Name of the Calibrating Agency	Whether Calibrating Agency is Govt. Approved.	Whether documents Relating to Govt. Approval of the Calibrating Agency furnished?	Whether the meters/equipment fulfill the accuracy class as per calibration report	Whether the calibrating agency has put any limitation towards the use of the particular meter/equipment. If yes, state the limitations	Whether green sticker or blue sticker or yellow sticker has been affixed on the body of the particular equipment/ meter. State the colour of the affixed sticker	Inspite of imposed limitations, whether the particular meter/ equipment can still be used? Justify its use for corresponding test(s)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

ANNEXURE – D

CHECK LIST TOWARDS TYPE TEST REPORTS

Name of the Type test	Date of Test	Name of the Laboratory where the Test has been conducted.	Whether the Laboratory is Government Approved	Whether the Test reports are valid as per Clause No.7.21 of T.S.	Whether the copy of Test Report in complete shape along with drawings etc. furnished or not?	Whether the Type Tested Surge Arrester fulfills the technical requirements as per TS.	If the type tested surge Arrester does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct the particular type test again at their own cost without any financial liability to ESU in the presence of CESU's representative within the specified delivery period.	Remarks
1	2	3	4	5	6	7	8	9

TECHNICAL SPECIFICATION FOR SPUN PRE STRESSED CONCRETE POLE

1.0 CONCRETE FOR SPUN PRE STRESSED POLES

1.1 Description

This work shall consist of the construction of all or portions of structures of Portland cement concrete, of the required grades and types, with or without reinforcement, pre stressed reinforcement and with or without admixture, in accordance with these Specifications and to the lines, levels, grades and dimensions shown on the Drawings and required by the Engineer.

Portland cement concrete shall consist of a mixture of Portland cement, water and coarse and fine aggregate with or without admixture.

Spun Pre Stressed pole shall be confirming to the following specification:

Sl. No.	Description	Requirements (minimum)
1	Pole type	Spun Pre stressed
2	Length, m	12
3	Top diameter, mm	260
4	Bottom diameter, mm	433
5	Pole ultimate load, kg	2200
6	All holes provided with U.V. resistant, plastic plugs	To be provided
7	M12 x 30 mm bolt and washer for earthing nut	To be provided
8	M12x 30 mm bolt with washer for attaching top cap	To be provided
9	Straightness of the pole	As per standards

1.1.1 Materials

Specifications for Materials

A) Cement

Cement shall conform to the requirements of AASHTO Standard Specification M 85 type 1, normal Portland cement, unless other types are indicated on the Drawings or specified by the Engineer.

Cement shall be sampled and tested in accordance with STP Sections 2.6 and 8. Bagged or bulk cement which has partially set or which contains lumps of caked cement shall be rejected. The use of cement reclaimed from discarded or used bags shall not be permitted.

B) Water

The water used in mixing and curing concrete shall be tested by methods described in AASHTO Test Method T 26. All water shall be clean and free from salt, oil, acid, vegetable or other substance injurious to the finished product. The use of river water will be subject to the approval of the Engineer. Such approvals may be withdrawn from time to time depending on the condition of the river.

C) Admixtures

Admixtures or any other additions shall not be used except with the written approval of the Engineer.

Admixtures, if specified or permitted, shall fully conform to the requirements of AASHTO Standard Specification M 194-74.

D) Coarse Aggregate

Coarse aggregate for all types of concrete with the exception of blinding concrete shall consist of hard durable crushed or broken rock and generally conform to the requirements of AASHTO Standard Specification M 80. Coarse aggregate shall be clean, free from dust and other deleterious material.

The amounts of deleterious substances shall not exceed the following limits:

1) Soft fragments; 2% by mass

2) Clay lumps; 0.25% by mass
3) Material Passing the 0.075 mm sieve; 0.50% by mass if clay,

1.50% by mass if fracture dust In addition, coarse aggregates shall comply with the following:

1) Thin or elongated pieces; Flakiness Index (STP 7.3.1) less than 30

2) The aggregate crushing value (STP 7.7.1) shall be less than 30% and the ten percent fines value (STP 7.7.2) shall be greater than 150 kN.

The grading of coarse aggregate of maximum size 20 mm shall conform to Table 5.1-1 below. The grading of 40 mm maximum size coarse aggregate shall be in accordance with AASHTO Standard Specification M 80.

Table 5.1-1

Grading Requirements for 20 mm Maximum Size Coarse	
Sieve Size (mm)	**% Passing by Weight**
25	100
20.0	90 - 100
12.5	20 - 55
10.0	5 - 20
5.0	0 - 5
2.4	-
1.2	-

In heavily reinforced structures with difficult casting conditions smaller size aggregates may be used if approved by the Engineer.

E) Fine Aggregate

Fine aggregate shall consist of natural sand and fine aggregates from different sources of supply shall not be mixed or stored in the same pile.

The amounts of deleterious substance when tested in accordance with STP 3.4 shall not exceed the following limits:

1) Friable Particles; 0.5% by mass

2) Coal and Lignite; 0.5% by mass

3) Material passing the 0.075 mm sieve; 3.0% by mass

4) Any other deleterious materials shall not cause a strength reduction of the concrete of more than 5% in relation to the strength of concrete free of the concerned deleterious material.

The grading shall normally be in accordance with Table 5.1-2. In the event that it is not possible to obtain regular supplies of sand conforming to this grading, the Engineer may approve the adoption of a grading conforming to the requirements of table 4 with additional limits of either C or M of BS 882: 1992. However, any additional costs resulting from changes in aggregate proportions or additional cement contents required to achieve the specified strengths, when using these alternative gradings, shall be borne by the Contractor and shall not be reimbursed.

Table 5.1-2

Grading Requirements for Fine Aggregate	
Sieve Size (mm)	% Passing by Weight
10.0	5 - 20
5.0	95 – 100
1.2	45 – 80
0.30	10 – 30
0.15	2 – 10

1.1.2 Testing of Materials

F) Cement

Cement shall be in accordance with AASHTO M 85. The Contractor must provide the Engineer with manufacturer's certificates indicating compliance.

Cement shall be sampled and tested for fineness, setting time and strength in accordance with STP 8.1, STP 8.2 and STP 8.3, respectively, at the Contractor's expense. The Contractor shall notify the Engineer of delivery dates so that there will be sufficient time for sampling the cement, either at the mill or upon delivery. If this is not done, the Contractor

may be required to re-handle the cement in the store for the purpose of obtaining the required samples.

Sampling shall normally be instructed by the Engineer for every batch of cement prior to this cement being incorporated in the Works.

G) Water

The water proposed by the Contractor to be used in mixing or curing concrete shall be tested by methods described in AASHTO Test Method T 26.

In sampling water for testing, care shall be taken that the containers are clean and that samples are representative.

When comparative tests are made with a water of known satisfactory quality, any indication of unsoundness, marked change in time of setting, or a reduction of more than 10 percent in mortar strength, shall be sufficient cause for rejection of the water under test.

The water shall be tested at a recognised laboratory approved by the Engineer. The test result shall be signed by the laboratory. The water shall be tested before commencement of work or if the source is changed or at any time required by the Engineer. All testing shall be carried out at the Contractor's expense.

H) Admixtures

The Contractor shall submit specifications and samples of any admixtures or additives that he proposes to use to the Engineer at least 28 days before the commencement of construction or manufacture of the particular structure on which he intends to use such admixtures.

Any tests the Engineer may require on concrete mixes on account of the Contractor's proposal to use additives shall be carried out at the expense of the Contractor.

I) Aggregates

1) Selection and Approval

From the aggregate materials proposed by the Contractor, samples shall be selected according to STP Section 2.4 and in the presence of the Engineer. The samples shall be tested at the site laboratory or at an approved testing laboratory for conformance with Section 5.1.2.1 of these Specifications.

2) Quality Control

The quality control of the aggregate shall be as directed by Engineer. Gradings shall normally be checked daily.

Moisture contents of fine aggregate shall be determined daily and at any time when a change in moisture content is expected.

If the Contractor proposes to change the source of aggregate, the Engineer shall be informed in advance and in no case less than 3 weeks before the new aggregate shall be used.

3) Composition of Concrete

J) Classes of Concrete

Concrete with cement type 1 for incorporation in the Works shall be of the classes indicated on the Drawings and shall comply with Table 5.1-3.

Table 5.1-3

Concrete Class	Concrete Characteristic Strength (N/mm2 @ 28 days)		Maximum Size of Coarse Aggregate (mm)	Minimum Cement Content (Kg/m3)
	Cylinder (150 x 300 mm)	Cube (150 mm)		
7	7	9	40	180
			20	210
10	10	13	40	210
			20	240
15	15	19	40	250
			20	280
20	20	25	40	300
			20	320
25	25	31	40	340
			20	360
30	30	37	40	370
			20	400
35	35	44	40	400
			20	430

K) Proportioning

When designing the concrete mix, the Contractor shall consider the following conditions:

1) Strength

The class of the concrete is to be as shown on the Drawings. The class is the specified characteristic cylinder strength at 28 days. Concrete mixes shall be designed to comply with Specifications Section 5.1.2.4.

2) Water/Cement Ratio

The ratio of free water to cement when using saturated surface dry aggregate shall be as low as possible and not exceed 0.50 by weight for all concrete, except for blinding concrete where it shall not exceed 0.6, unless approved by the Engineer.

For concrete in barriers, edge beams and bridge decks directly exposed to traffic or concrete in pile caps or abutments in contact with the ground, the water cement ratio shall not exceed 0.45, unless approved by the Engineer.

3) Minimum Cement Content

As indicated for the respective class in Table 5.1-2

4) Minimum Filler Content

Filler content (fine aggregate less than 0.25 mm and cement) shall not be less than as follows (except for mass concrete).

Maximum coarse aggregate size (mm)	20	40
Minimum filler content (kg/m^3 of concrete)	435	350

5) Coarse Aggregate

The maximum size of coarse aggregate will generally be stated on the Drawings; either 40 mm or 20 mm, in accordance with Table 5.1-1. Grading and quality is to comply with the requirements of Section 5.1.2.1(D).

6) Fine Aggregate

The grading and quality is to comply with the requirements of Section 5.1.2.1.

7) Workability

The concrete shall be of suitable workability to obtain full compaction. Slumps measured in accordance with STP 9.1 shall not exceed 75 mm unless otherwise indicated on the Drawings or approved by the Engineer.

L) Trial Mixes

After the Contractor has received approval for the cement and aggregate to be used, he shall prepare trial mixes with concrete of designed proportions to prove and establish workability, strength, water cement/ratio, surface criteria etc. Methods of transporting fresh concrete and the compaction equipment shall be considered. The trial mixes shall be made and compacted in the presence of the Engineer, using the same type of plant and equipment as will be used for the Works.

From each trial mix, cylinders or cubes shall be made and tested in accordance with Section 5.1.2.4.

From the same mix as that from which the test specimens are made, the workability of the

concrete shall be determined by the slump test in accordance with STP 9.1. The remainder of the mix shall be cast in a wooden mould and compacted. After 24 hours the sides of the mould shall be struck and the surface examined in order to satisfy the Engineer that an acceptable surface can be obtained with the mix.

The trial mix proportions should be approved if the required strength is obtained from tests carried out in accordance with Section 5.1.2.4 and the consistency and surface is to the satisfaction of the Engineer.

When a mix has been approved, no variations shall be made in the mix proportions, or in the type, size, grading zone or source, of any of the constituents without the consent of the Engineer, who may require further trial mixes to be made before any such variations are approved.

Until the results of trial mixes for a particular class have been approved by the Engineer, no concrete of the relevant class shall be placed in the Works.

When the Contractor intends to purchase factory-made precast concrete units, trial mixes may be dispensed with provided that evidence is given to satisfy the Engineer that the factory regularly produces concrete which complies with the Specifications. The evidence shall include details of mix proportions, water/cement ratios, slump tests and strengths obtained at 28 days.

8) Control of Concrete Quality

M) General

The Contractor shall assume the full responsibility for the quality of the concrete conforming to these Specifications and this responsibility shall not be relieved by the testing carried out and approved by the Engineer.

The Contractor shall thus at his own discretion establish additional testing procedures as necessary.

N) Control of Concrete Production

9) Materials

Materials used shall be tested in accordance with Section 5.1.2.2.

10) Plant and Equipment

Batching plants will be tested by the Contractor in a manor approved by the Engineer before any major concrete casting and at any other time if requested by the Engineer.

11) Fresh Concrete

The frequency of slump tests shall be as directed by the Engineer, with at least one test per 25 m^3 of concrete.

O) Control of Strength

12) Sampling and Testing

Cube tests may be substituted for cylinder tests if acceptable to both the Engineer and the Contractor. If cube tests are adopted, the concrete characteristic strengths shall be as shown in Table 5.1-2. All other requirements of the Specifications shall equally apply to cubes or cylinders.

The Contractor shall take samples of the concrete for testing. The number, frequency and location shall be decided by the Engineer. A minimum of 3 concrete cubes/cylinders should be taken for each day's casting, or for every 15 m³ of concrete cast in large pours. The slump of concrete samples shall be measured.

The procedures for sampling and making cubes/cylinders and testing them shall be as described in STP 9.2.

13) Strength Requirement

The results of the testing shall conform to the strength requirements according to British standard BS5400: Part 7, as given below, or to any mathematically correct statistical test for each casting section.

P) General

The characteristic strength of concrete is the 28 days strength below which not more than 5% of the test results may be expected to fall.

Q) Target Mean Strength

The concrete mix should be designed to have a mean strength greater than the required characteristic strength by at least the current margin.

The current margin for each particular type of concrete mix shall be determined; it may be taken as having the smaller of the values given by (1) or (2) below.

14) 1.64 times the standard deviation of tests on at least 100 separate batches of concrete of nominally similar proportions of similar materials and produced over a period not exceeding 12 months by the same plant under similar supervision.

15) 1.64 times the standard deviation of tests on at least 40 separate batches of concrete of nominally similar proportions of similar materials and produced over a period exceeding 5 days but not exceeding 6 months by the same plant under similar supervision.

Where there are insufficient data to satisfy (1) or (2) above, the margin for the initial mix design should be taken as two-thirds of the characteristic strength for concrete. This margin should be used as the current margin only until sufficient data are available to satisfy (1) or (2) above. However, when the required characteristic strength approaches the maximum possible strength of concrete made with a particular aggregate, a smaller margin may be permitted by the Engineer for the initial mix design.

R) Testing Plan

Each cube shall be made from a single sample taken from randomly selected batches of concrete.

Compliance with the specified characteristic strength may be assumed if:

16) The average strength determined from any group of four consecutive test cubes exceeds the specified characteristic strength by not less than 0.5 times the current margin, and

17) Each individual test result is greater than 85% of the specified characteristic strength.

The current margin should be taken to be two-thirds of the specified characteristic strength for concrete, unless as mentioned above a smaller margin has been established to the satisfaction of the Engineer.

If only one cube result fails to meet the second requirement then that result may be considered to represent only the particular batch of concrete from which that cube was taken provided the average strength of the group satisfies the first requirement.

If more than one cube in a group fails to meet the second requirement or if the average strength of any group of four consecutive test cubes fails to meet the first requirement then all the concrete in all the batches represented by all such cubes shall be deemed not to comply with the strength requirements. For the purposes of this sub-Section, the batches of concrete represented by a group of four consecutive test cubes shall include the batches from which samples were taken to make the first and the last cubes in the group of four, together with all the intervening batches.

S) Action to be Taken in the Event of Non-Compliance with the Testing Plan

When the average strength of four consecutive test cubes fails to meet the first requirement in (F), above, the mix proportions of subsequent batches of concrete should be modified to increase the strength.

The action to be taken in respect of the concrete which is represented by the test-cubes which fail to meet either of the requirements (or not by correct statistical proof can be verified to have the required strength) shall be determined by the Engineer. This may range from qualified acceptance in less severe cases, to rejection and removal in the most severe cases.

The Engineer may also require the Contractor at his own expenses to prove statistically the strength, by boring out cores and testing them according to a programme approved by the Engineer. The age of the concrete and degree of hardening at the time of the new testing shall be considered. The equivalent cylinder/cube strength shall comply the minimum characteristic strength or as decided by the Engineer.

T) Control of Hardening

If the Contractor wants to remove forms and scaffolding earlier than specified herein, extra test specimens shall be cast by the Contractor in accordance with the instruction of the Engineer. These specimens shall be tested the day before removal of the form. On the basis of the test results the Engineer shall take the final decision on the time for the removal of forms.

For pre stressed concrete, extra test specimens shall be cast by the Contractor in accordance with the instructions of the Engineer, to determine the time for tensioning the tendons. On the basis of the test results, the Engineer shall decide upon the time for pre stressing the concrete.

1.2 Construction Methods

1.2.1 General

The Contractor shall in due time and as soon as possible present and discuss his construction methods and work programme with the Engineer and shall obtain his approval before commencement of any work.

The Contractor shall maintain an adequate number of trained and experienced supervisors and foremen at the Site to supervise and control the work.

All construction, other than concrete, shall conform to the requirements prescribed in other Sections of the Specifications, for the particular items of work comprising the complete structure.

1.2.2 Scaffolding and Formwork

U) Scaffolding (Falsework)

Details, plans and structural calculations for scaffolding shall be submitted by the Contractor to the Engineer for approval, but in no case shall the Engineer's approval relieve the Contractor of his Contract responsibilities. All scaffolding shall be designed and constructed by the Contractor to provide the necessary rigidity and to support dead and live loads without deflection or deformation. The Engineer may require the Contractor to employ screw jacks or hardwood wedges to take up any settlement in scaffolding and formwork, either before or during the placing of concrete.

Tests may be required by the Engineer of materials proposed by the Contractor for scaffolding. Test loadings of the completed scaffolding may also be required for the determination of flexibility and strength. All expenses associated with testing shall be borne by the Contractor.

Scaffolding which cannot be founded on a satisfactory footing shall be supported on piles, which shall be spaced, driven and removed in a manner approved by the Engineer. When the Contractor wishes to support scaffolding on existing structures, he shall submit his proposals in due time to the Engineer, in writing, including loads from the scaffolding. The Engineer will consider the proposals and respond in writing.

Scaffolding shall be set to give the finished structure a camber, if indicated on the Drawings or specified by the Engineer.

Scaffolding shall remain in place for periods which shall be determined by the Engineer.

V) Formwork

Formwork shall include all temporary or permanent moulds for forming the concrete. Formwork shall be of wood, metal or other approved materials and shall be built mortar tight and rigid enough to maintain the concrete in position during placing, compacting, setting and hardening.

Formwork for exposed surfaces ("wrought form") shall be made of dressed lumber of uniform thickness with or without a form liner of an approved type or shall be of metal sufficiently rigid in itself with no surface blemishes that will impair the quality of the concrete surface finish. No rusty or bent metal forms shall be used. Exposed concrete arises shall be

provide with formed chamfers, as indicated on the Drawings or instructed by the Engineer.

Rough lumber may be used for surfaces that will not be exposed in the finished structure ("rough form").

All lumber shall be sound, free from warps and twists, sap, shakes, large or loose knots, wavy edge or other defects affecting the strength or appearance of the finished structure.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods, which shall be determined by the Engineer. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer may order the work stopped until the defects are corrected.

If requested, the Contractor shall submit to the Engineer working drawings of the forms and also, if requested, calculations to verify the rigidity and strength of the forms.

The shape, strength, rigidity, water tightness and surface smoothness of reused formwork shall be maintained at all times. Any warped or bulged lumber must be re- sized before being reused. Formwork that is unsatisfactory in any respect shall not be reused.

Metal ties or anchorages within the form shall be so constructed as to permit their removal to a depth of at least 50 mm from the face without injury to the concrete. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be of the smallest possible size. The cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in colour.

Formwork shall be so constructed that easy cleaning out of any extraneous material inside the formwork can be achieved without disturbing formwork already checked and approved by the Engineer.

Formwork shall be treated with approved non-staining oil or saturated with water, to facilitate formwork removal. The Engineer may require trials to be carried out before approval is given for the use of a particular type of oil, to ascertain that the oil proposed by the Contractor does not discolour or injure the finished concrete face in any way.

Before placing any concrete, all shavings, loose binding wires, soil, rubbish and all foreign matter shall be removed from the formwork and the formwork shall be carefully and thoroughly washed with water. If not indicated otherwise, the following tolerances of the finished concrete structures shall apply:

Foundations: horizontally + 30 mm; vertically + 20 mm

Piers: Horizontally + 20 mm, vertically + 10 mm, inclination 1:400

Dimensions of other structural members: + 10 mm, -5 mm

Edge beams and parapets shall be made to such accuracy that no deviations from the correct alignment are visible.

The cross sectional areas of the superstructure of bridges shall in no place deviate more than 3% from the theoretically correct cross sectional areas.

Anchors for bearings, expansion joints, railings, etc. shall be placed within the tolerances indicated on the Drawings or specified by the Engineer.

W) Blinding Concrete on Single Layer Brick Flat Soling

A levelling layer of blinding concrete shall be provided as the permanent bottom form for all concrete structures that will directly bear on prepared soil, whether this blinding concrete is shown on the Drawings or not. The levelling layer of blinding concrete shall be of thickness not less than 75 mm and shall be constructed on single layer brick flat soling.

X) Approval of Scaffolding and Formwork

If plans and calculations of scaffolding and formwork are requested by the Engineer, no construction of such scaffolding and formwork shall take place before approval by the Engineer, in writing. Such approval shall not relieve the Contractor of his responsibilities under the Contract for the adequacy of scaffolding and formwork.

The Engineer shall have reasonable time for his examination of the Contractor's plans and calculations, especially if scaffolding is introducing temporary loading on new structures. The Contractor shall not be allowed extensions of Contract time due to awaiting such approval.

The Engineer shall inspect all formwork and scaffolding and no concrete shall be placed until the Engineer's approval has been given. Such approval shall not relieve the Contractor of any of his responsibilities under the Contract for the successful completion of the structure.

1.2.3 Care and Storage of Concrete Materials

Y) Storage of Cement

All cement shall be stored in suitable weatherproof buildings or silos which will protect the cement from dampness. These buildings or silos shall be placed in locations approved by the Engineer. Provisions for storage shall be ample, and the shipments of cement as received shall be separately stored in such manner as to provide easy access for the identification and inspection of each shipment. Storage buildings shall have a capacity for the storage of a sufficient quantity of cement to allow sampling at least 14 days before the cement is to be used. Cement shall meet the test requirements at any time and any cement stored for an elongated time shall be checked and tested before use regardless of whether it has previously been tested.

Z) Storage of Aggregates

Aggregates shall be so stored as to prevent the inclusion of foreign material. Aggregates shall not be placed upon the finished roadbed. Aggregates of different sizes and kinds shall be placed in different stockpiles. Stockpiles of blended coarse aggregates shall be built up in successive horizontal layers not more than 1 metre thick. Each layer shall be completed before the next is started. Should segregation occur, the aggregates shall be recombined to conform to the grading requirements.

Washed aggregates and aggregates produced or manipulated by methods which involve the use of water shall be allowed to drain at least 12 hours before use.

1.2.4 Preparations Before Casting

Before any major casting, the Contractor shall prepare a complete "casting programme" describing staff and labour, consumption of materials, plant, tools and equipment, reserves

of materials, standby plant and equipment, proposed means of handling and placing the concrete, quality controls etc.

No concrete shall be mixed and placed until the Contractor's casting programme has been approved in writing by the Engineer.

Equipment and tools necessary for handling materials and performing the work, and satisfactory to the Engineer as to design, capacity, and mechanical condition, shall be at the site of the work before casting is started.

If any equipment is not maintained in full working order, or if the equipment as used by the Contractor proves inadequate to obtain the result prescribed, such equipment shall be repaired or other suitable equipment substituted or added at the discretion of the Engineer.

1.2.5 Measuring Materials

All material in the mix shall be proportioned by weight or volume, subject to the approval of the Engineer.

When volume batching is proposed by the Contractor, the exact proportions must be converted from trial mix weights to volumes, from bulk densities determined in the laboratory. Written approval from the Engineer is required.

1.2.6 Mixing Concrete

AA) General

All concrete shall be mixed in batch mixers, either at the site of construction, at a central plant, or in transit. Each mixer shall have attached to it in a prominent place, a manufacturer's plate showing the capacity of the drum in terms of mixed concrete and the speed of rotation of the mixing drum.

BB) Mixers at Local Site of Construction

Mixers at local sites shall be approved drum-type capable of combining the aggregate, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period and of discharging the mixture without segregation. The mixer shall be equipped with a suitable charging hopper, water storage and a water measuring device, accurate within 1%. Controls shall be so arranged that the water can be applied only while the mixer is being charged. Suitable equipment for discharging the concrete shall be provided. The mixer shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum shall be replaced when they have lost 10% of their depth.

The mixer shall be operated at a drum speed of between 15 and 20 revolutions per minute. The batched materials shall be so charged into the drum that a portion of the water shall enter in advance of the cement and aggregates and the water shall continue to flow into the drum for a minimum time of 5 seconds after all the cement and aggregates are in the drum. Mixing time shall be measured from the time all materials except water are in the drum and shall, in the case of mixers having a capacity of 1 cubic metre or less, not be less than 50 seconds nor more than 70 seconds. In the case of dual drum mixers, the mixing time shall not include transfer time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein. Any concrete mixed less than the specified minimum time shall be discarded and disposed of by the Contractor at his own expense.

The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in

cubic feet or cubic metres as shown on the manufacturer's guaranteed capacity standard rating plate on the mixer; except that an overload up to 20% of the mixers nominal capacity may be permitted provided concrete test data for strength, segregation and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

Re tempering concrete by adding water or by other means shall not be permitted. Concrete which is not of the required consistency at the time of placement shall not be used and shall be discarded and disposed of by the Contractor at his own expense.

CC) Central Plant Mixers

These mixers shall be of approved drum type capable of combining the aggregate, cement and water into a thoroughly mixed and uniform mass within the specified mixing period and of discharging the mixture without segregation. Central plant mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. The water system for a central mixer shall be either a calibrated measuring tank or a meter and shall not necessarily be an integral part of the mixer.

The mixers shall be cleaned at suitable intervals. They shall be examined daily for changes in interior condition. The pick up and throw-over blades in the drum shall be replaced when they have lost 10% of their depth.

In addition to the requirements for mixers at local sites detailed above, central plant mixers which have a capacity of between 2 and 5 cubic metres, or greater than 5 cubic metres, should have a minimum mixing time of 90 and 120 seconds respectively, provided tests indicate that the concrete produced is equivalent in strength and uniformity to that attained as stated in the preceding paragraphs.

Mixed concrete shall be transported from the central mixing plant to the site of work in agitator trucks or, upon written permission of the Engineer, in non-agitator trucks. Delivery of concrete shall be so regulated that placing is at a continuous rate unless delayed by the placing operations. The intervals between delivery of batches shall not be so great as to allow the concrete in place to harden partially, and in no case shall such an interval exceed 30 minutes.

DD) Agitator Trucks

Unless otherwise permitted in writing by the Engineer, agitator trucks shall have watertight revolving drums suitably mounted and shall be capable of transporting and discharging the concrete without segregation. The agitating speed of the drum shall not be less than two or more than six revolutions per minute. The volume of mixed concrete permitted in the drum shall not exceed the manufacturer's rating nor exceed 80% the gross volume of the drum.

Upon approval by the Engineer, open-top, revolving-blade truck mixers may be used in lieu of agitating trucks for transportation of central plant mixed concrete.

Gross volume of agitator bodies expressed in cubic feet or cubic metres shall be supplied by the mixer manufacturer. The interval between introduction of water into the mixer drum and final discharge of the concrete from the agitator shall not exceed 45 minutes. During this interval the mix shall be agitated continuously.

EE) Non-Agitator Trucks

Bodies of non-agitating equipment shall be smooth, water-tight metal containers equipped with gates that will permit control of the discharge of the concrete. Covers shall be provided

when needed for protection against the weather.

The non-agitating equipment shall permit delivery of the concrete to the site of the work in a thoroughly mixed and uniform mass with a satisfactory degree of discharge.

Uniformity shall be satisfactory if samples from the one-quarter and three quarter points of the load do not differ by more than 30 mm in slump. Discharge of concrete shall be completed within 30 minutes after the introduction of the mixing water to the cement and aggregate.

FF) Truck or Transit Mixers

These shall be equipped with electrically actuated counters by which the number of revolutions of the drum or blades may readily be verified and the counters shall be actuated at the commencement of mixing operations at designated mixing speeds. The mixer when loaded shall not be filled to more than 60% of the drum gross volume. The mixer shall be capable of combining the ingredients of the concrete into a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity.

Except when intended for use exclusively as agitators, truck mixers shall be provided with a water measuring device to measure accurately the quantity of water for each batch. The delivered amount of water shall be within plus or minus 1% of the indicated amount.

Truck mixers may be used for complete mixing at the batch plant and as truck agitators for delivery of concrete to job sites, or they may be used for complete mixing of the concrete at the job site. They shall either be a closed watertight revolving drum or an open top revolving blade or paddle type.

The amount of mixing shall be designated in number of revolutions of the mixer drum. When a truck mixer is used for complete mixing, each batch of concrete shall be mixed for between 70 and 100 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of the equipment as the “mixing speed”. Such designation shall appear on a metal plate attached to the mixer. If the batch is at least
0.5 cubic metres less than guaranteed capacity, the number of revolutions at mixing speed may be reduced to not less than 50. Mixing in excess of 100 revolutions shall be at the agitating speed. All materials, including the mixing water, shall be in the mixer drum before actuating the revolution counter which will indicate the number of revolutions of the drum or blades.

When wash water (flush water) is used as a portion of the mixing water for the succeeding batch, it shall be accurately measured and taken into account in determining the amount of additional mixing water required. When wash water is carried on the truck mixer, it shall be carried in a compartment separate from the one used for carrying or measuring the mixing water. The Engineer will specify the amount of wash or flush water, when permitted, any may specify a “dry” drum if wash water is used without measurement or without supervision.

When a truck is used for complete mixing at the batch plant, mixing operations shall begin within 30 minutes after the cement has been added to the aggregate. After mixing, the truck mixer shall be used as an agitator, when transporting concrete, at the speed designated by the manufacturer of the equipment as agitating speed. Concrete discharge shall be completed within 45 minutes after the addition of the cement to the aggregates. Each batch of concrete delivered at the job site shall be accompanied by a time slip issued at the batching plant, bearing the time of departure there from. When the truck mixer is used for the complete mixing of the concrete at the job site, the mixing operation shall begin within 30 minutes after the cement has been added to the aggregates.

The rate of discharge of the plastic concrete from the mixer drum shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.

1.2.7 Handling and Placing Concrete

The temperature of concrete at the time of placing shall not exceed 35^{o}C.

In preparation for the placing of concrete all sawdust, chips and other construction debris and extraneous matter shall be removed from the interior of forms. Struts, stays and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and not buried in the concrete.

Concrete must reach its final position in the forms within 20 minutes of the completion of mixing, or as directed by the Engineer.

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. The use of long troughs, chutes and pipes for conveying concrete from the mixer to the forms shall be permitted only on written authorisation of the Engineer. In case an inferior quality of concrete is produced by the use of such conveyors, the Engineer may order discontinuance of their use and the institution of a satisfactory method of placing.

Open troughs and chutes shall be of metal or metal lined. Where long steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement.

All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the structure.

When placing operations would involve dropping the concrete more than 1.5 m, it shall be deposited through sheet metal or other approved pipes. As far as practicable, the pipes shall be kept full of concrete during placing and their lower ends shall be kept buried in the newly placed concrete. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of reinforcement bars which project.

Concrete, during and immediately after depositing, shall be thoroughly compacted. The compaction shall be done by mechanical vibration subject of the following provisions:

1) The vibration shall be internal unless special authorisation of other methods is given by the Engineer or as provided herein.

2) Vibrators shall be of a type and design approved by the Engineer. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

3) The intensity of vibration shall be such as to visibly affect a mass of concrete of 20 mm slump over a radius of at least 450 mm.

4) The Contractor shall provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.

5) Vibrators shall be manipulated to thoroughly work the concrete around the

reinforcement and embedded fixtures, and into the corners and angles of the forms.

Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted and withdrawn from the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localised areas of grout are formed.

Application of vibrators shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

6) Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

7) Vibration shall be supplemented by such spading as is necessary to ensure smooth surfaces and dense concrete along form surfaces and in corners and locations impossible to reach with the vibrators.

8) The provisions of this Section shall also apply to precast piling, concrete cribbing and other precast members except that, if approved by the Engineer, the manufacturer's methods of vibration may be used.

Concrete shall be placed in horizontal layers not more than 600 mm thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between the batches. Each layer shall be compacted so as to avoid the formation of a construction joint with a preceding layer which has not taken initial set.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 150 mm in the succeeding layer. Work shall not be discontinued within 450 mm of the top of any face, unless provision has been made for a coping less than 450 mm thick, in which case, if permitted by the Engineer, a construction joint may be made at the underside of the coping.

Immediately following the discontinuance of placing concrete all accumulations of mortar splashed upon the reinforcement steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to injure or break the concrete-steel bond at and near the surface of the concrete, while cleaning the reinforcement steel.

For simple spans, concrete shall preferably be deposited by beginning at the centre of the span and working from the centre toward the ends. Concrete in girders shall

be deposited uniformly for the full length of the girder and brought up evenly in horizontal layers. For continuous spans, the concrete placing sequence shall be as shown on the plans or agreed on by the Engineer.

Concrete in slab and girder haunches less than 1.0 metre in height shall be placed at the same time as that in the girder stem.

Concrete in slab spans shall be placed in one continuous operation for each span unless otherwise provided.

Concrete in T-beam or deck girder spans may be placed in one continuous operation if permitted by the Engineer.

Concrete in columns and pier shafts shall be placed in one continuous operation, unless otherwise directed.

Unless otherwise permitted by the Engineer, no concrete shall be placed in the superstructure until the column forms have been stripped sufficiently to determine the character of the concrete in the columns. The load of the superstructure shall not be applied to the supporting structures until they have been in place at least 14 days, unless otherwise permitted by the Engineer.

Pneumatic placing of concrete shall be permitted only if authorised by the Engineer. The equipment shall be so arranged that vibration does not damage freshly placed concrete.

Where concrete is conveyed and placed by pneumatic means the equipment shall be suitable in kind and adequate in capacity for the work. The machine shall be located as close as practicable to the place of deposit. The position of the discharge end of the line shall not be more than 3 metres from the point of deposit. The discharge lines shall be horizontal or inclined upwards from the machine. At the conclusion of placement the entire equipment shall be thoroughly cleaned.

Placement of concrete by pumping shall be permitted only if authorised by the Engineer. The equipment shall be so arranged that vibrations do not damage freshly placed concrete. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there is not contamination of the concrete or separation of the ingredients. After this operation, the entire equipment shall be thoroughly cleaned.

EARTHWORK

EARTHWORK

1.0 CLEARING AND GRUBBING

1.1 Description

This work shall consist of all clearing and grubbing necessary for the performance of the work covered by the Contract in accordance with the Specifications.

The clearing and grubbing shall in more detail consist of clearing the designated areas of all trees, down timber, vegetation, rubbish and any other objectionable materials and shall include grubbing roots and stumps and disposing of all material resulting from the clearing and grubbing. It shall also include the demolition, removal and disposal of structures that obtrude the Works except where provided for in Section 2.9.

Clearing shall be confined to the areas enclosed by the right-of-way limits. Grubbing shall be confined to areas covered by the Works.

1.2 Preservation of Property

Attention is directed to the Contractor's obligations under the Contract with regard to damage, particularly with regard to protection of property, gardens and landscape and to responsibility for damage claims. Existing roads, improvements, facilities, adjacent property, utilities, services and trees and plants designated for preservation shall be protected from injury or damage which could result from the Contractor's operations.

1.3 Construction Methods

1.3.1 Clearing

Clearing shall consist of the removal and disposal of everything above ground level including overhanging branches except those things the Engineer directs are to be left undisturbed. The material to be cleared shall include but not necessarily be limited to trees, stumps, logs, brush, undergrowth, grass, crops, loose vegetable matter and structures unless provided for elsewhere. Trees and stumps shall be cut to ground level.

Clearing shall also include the removal of existing fences, remnants of buildings and courtyard pavements etc.

The roadway and adjacent areas shall be left with a neat and finished appearance. No accumulation of inflammable material shall remain on or adjacent to the right-of-way.

1.3.2 Grubbing

The original ground surface shall be disturbed as little as possible. Grubbing shall, therefore, be confined to major roots beneath the embankment, ditches, canal diversions and footing excavations. In these areas grubbing shall consist of the removal of all major stumps, embedded logs, tree roots and other material, except as otherwise directed by the Engineer. Holes left shall be filled with suitable material compacted to comply with Section 2.6 of the Specification with the cost of this being deemed to be included in the rate for grubbing. Topsoil shall be removed as agreed with the Engineer and will be measured as roadway excavation. Grubbing beneath the embankment shall be at the direction of the Engineer.

In agricultural areas where the ground has been formed into ridges or dikes, the ground shall be roughly levelled or graded to form a surface suitable for embankment foundation to the satisfaction of the Engineer.

1.3.3 Ownership of Cleared Material

All cleared material shall, unless otherwise provided for in the Contract, be the property of the Employer. Materials shall be stockpiled, or placed, by the contractor on site in a location agreed by the Engineer.

1.3.4 Existing Drainage

Existing ditches, drainage channels etc., shall be closed at the embankment foundation boundary except where pipes or other structures are prescribed. Disused drains below embankments shall be removed and trenches filled in accordance with Section 2.4.

The Contractor is responsible for undertaking any provisional drainage measures, including temporary watercourses and ditches, which may be necessary.

1.4 Measurement

Neither the work of clearing nor grubbing disposal sites, material sites, nor imported borrow pit sites shall be paid for when such sites are outside the areas designated for clearing or grubbing and the Contractor is permitted to exercise his own option as to whether he elects to use such disposal sites or borrow pit sites.

1.5 Payment

Clearing and grubbing will be paid by area. The payment shall be full compensation for furnishing all labour, materials, tools, equipment and incidentals necessary for the clearing and grubbing the designated areas as specified in these Specifications or as directed by the Engineer including the removal and disposal of all resulting material.

TECHNICAL SPECIFICATION FOR ALL ALUMINIUM ALLOY CONDUCTOR (AAAC)

TECHNICAL SPECIFICATION FOR ALL ALUMINIUM ALLOY CONDUCTOR (AAAC)

1.0 All Aluminium Alloy Conductor (AAAC)

1.1 This specification covers details of all aluminium alloy stranded conductors for use on 33 kV, overhead lines in Incoming Transmission system. All sizes of conductor shall be supplied with BSTI standards.

1.2 The AAAC conductor shall be 150.0 Sq.mm size with following standards:

Actual area in Sq.mm	Stranding & wire dia in mm	Approx. overall dia. mm	Approx. mass kg/ km	Calculated resistance at 20 d.c. (max.)	Approx. calculated Breaking Load in kN	Rated Current in Amps
150	19/3.15	15.75	407	0.229	43.5	291

No negative tolerance shall be permitted on the nominal diameter aluminium wire used in the manufacture of AAAC.

The wire shall be smooth and free from all imperfections such as spills , splits, slag inclusion , dia. marks scratches, fittings, blow holes, projections, looseness, overlapping of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding.

There shall be no joint in any wire of a stranded conductor containing seven wires except those made in the base rod or wire before final drawing.

In conductors containing more than seven wires, joints in individual wires are permitted in any layer except the outermost layer (in addition to those made in the brass rod or wire before final drawing) but no two such joints shall be less than 15 m apart in the complete stranded conductor, such joint shall be made by resistance or cold pressure butt welding. They are not required to fulfil the mechanical requirement of un jointed wires. Joints made by resistance butt
welding shall , subsequent to welding , be annealed over a distance of at least 200 mm on each side of the joint.

The wires used in the construction of a stranded conductor shall, before stranding satisfy all the relevant requirements of this standard

In all constructions, the successive layers shall have opposite directions of lay the outer most layer being right handed. The wires in each layer shall be evenly and closely stranded

In aluminium alloy stranded conductors having multiple layers of wires , the lay ratio of any layer shall not be greater than the lay ratio of the layer immediately beneath it.

The samples of individual wires for the test shall normally be taken before stranding . The manufacture shall carry out test on samples taken out at least from 10 % of the aluminium wire spools. However, when desired by the purchaser , the test sample may be taken from the stranded wires.

The wires used for alloy conductors shall comply with the following tests as per standards

1. Breaking load test
2. Elongation test
3. Resistance test

The standard length of AAA Conductor shall be 2 (two) kms. Tolerance of +/- 5%(plus or minus five percent)shall be permitted in this standard length. All the lengths outside these limits of tolerances shall be treated as random length.

The following information be marked on each package:

a. Manufacturer's name
b. Trade mark ,if any
c. Drum or identification number
d. Size of conductor
e. Number and lengths of conductors
f. Gross mass of the package
g. Net mass of conductor

1.3 String Insulator Fittings

All forgings and castings shall be of good finish and free from flaws and other defects.

All parts of different fittings which provide for connection, shall be made such that sufficient clearance is provided, at the connection point to ensure free movement and suspension of the insulator string assembly. All ball and socket connections shall be free in this manner. Care shall be taken that too much clearance between ball and socket is avoided.

All ferrous fittings and parts other than those of stainless steel, shall be hot deep galvanized, small fittings like spring washers, nuts etc. may be electro-galvanized.

Hardware sets suitable for only ball and socket type insulator shall be used. The nominal dimensions of the ball and socket eye, cross arm straps and assembly shall be as per standards.

The common snail type strain clamp shall be suitable for Coyote AAAC conductor.

The tension hardware with 3 or 4 bolts , shall have a minimum failing load , not less than 95 % of strength of respective conductor.

The suspension clamp shall have slip strength not exceeding 20% of conductor rated strength. The conductor shall not slip at loads less than 12.5% of rated strength of conductor.

Following test shall be carryout in the clamp:

a. Slip strength for suspension clamp and tension clamp.
b. Mechanical tests for clamps and hardware.
c. Galvanizing test.
d. Chemical composition test for component like ball eye, ball hook, cross arm, U bolts suspension clamp, snail clamp, tension clamp etc.

TECHNICAL SPECIFICATION FOR 11 KV DISC INSULATORS

TECHNICAL SPECIFICATION FOR 11 KV DISC INSULATORS

1.0 General technical requirement

The insulators shall be suitable for being installed directly in air, supported on suspension insulator hardware or anchored through tension insulator hardware at the power cross arms of single circuit, double circuit or multi circuit transmission line towers.

The insulator shall therefore be suitable for satisfactory operation under the tropical climatic conditions listed in the relevant clause. The applicable design particulars of the insulator to be used on these lines is furnished in "System Particulars".

The design of the insulator discs shall be such that all the stresses due to expansion or contraction in any part of the insulator under rapid temperature fluctuation, which may be created due to variation in the loads or fault of any nature, while in service shall not lead to any type of deterioration. Flat surface and corners shall not be allowed and shall be completely rounded off.

The porcelain shall not engage directly with the hard metal and all metal in contact with the cement shall be coated with the layer of chemically neutral and suitably yielding material or paint which shall act as a cushion and lubricant for the slight relative expansion and contraction of the parts.

The disc shall be cap and pin type with the ball and socket coupling. The caps and pins of the disc insulators shall be heavily galvanised and mechanically strong. The pin balls shall move freely in the cap sockets, but shall be so designed that they do not get disengaged while in service under various operating and atmospheric conditions.

The caps shall be made of heat treated malleable cast iron. These shall be free from cracks, shrinks, air holes, burrs and rough edges etc. The caps shall be circular with the inner and outer surfaces concentric and of such design that they will not yield or distort under stresses to the porcelain shells. The pins shall be of single piece made of high tensile forged steel hardened and tempered and shall be free from laps, folds, burrs, and rough edges. All bearing surfaces shall be smooth and uniform so as to distribute the loading stresses evenly. The pins shall be of such a design that they will not yield or distort under loaded condition. No joints in the pins shall be allowed, what so ever the joint type may be. The zinc sleeve shall be made of zinc having minimum 99.95 % purity.

Nominal dimensions of the pin, ball and socket interior shall be in accordance with the IS indicated above. The mechanical strength rating of the pin ball shank shall not be less than the electromechanical strength of the insulator discs as specified in this Specification.

The security clips for use with ball and socket coupling and split pins for use with cotter belts shall be made of phosphor bronze or stainless steel. The security clips shall provide positive locking of the coupling and shall be hump, back type of “W” shape for 90KN, and ‘R’ shape for 120KN and 160KN insulators in accordance with the relevant IEC. The logs of the security clips (split pins) shall be spread after installation to prevent withdrawal from the socket. The locking devices should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position. Under no circumstances shall the locking device allow separation of insulator units or fittings.

The finished porcelain shall be glazed to a chocolate brown colour. The glaze shall cover all the exposed porcelain parts of the insulators and shall have a bright luster smooth

surface and shall have a good performance under extreme weather conditions of tropical climate and heavily polluted atmosphere. The glaze shall not crack or get chipped due to ageing effect under normal and abnormal service conditions or while handling during transit or erection. The glaze shall have the same co-efficient of expansion as of porcelain body throughout the working range of the temperature.

An additional quantity of clips to the extent of 1.5 % shall be supplied with the insulators free cost.

The design of the fittings and the insulators shall be such that there is no local corona formation or discharges likely to cause the interference to either sound or vision transmission.

The bidder shall be responsible for satisfying himself that all the insulators including fittings in a string are suitable for the tower structures and conductors specified in this specification.

The insulators shall be of standard design and made to gauge or a jig and the same shall be interchangeable, in all respect with the similar items.

1.1 Materials

The insulators shall be manufactured from good quality porcelain insulating material as per approved design. The materials supplied shall be free from blow-holes, flaws, cracks, or other defects and shall be smooth, close – grained and of true forms and approved dimensions. All machined surfaces shall be true, smooth and well finished. The materials used shall comply with all the relevant ISS, BSS or other standards to be specified along with the due justifications.

The porcelain shall be Ivory white, non-porous, of high dielectric, mechanical and thermal strength. The materials shall be free from internal stresses, blisters, laminations, voids, foreign matters / particles, imperfection of other defects which might in way render it unsuitable as insulator shells. Porcelain shall be unaffected by climatic conditions, ozone, acids, alkalis, zinc, dust etc.

The porcelain shells shall be made by wet process. They shall be clean, dense, homogeneous, and shall be fired to a complete and uniform verification so that glaze is not depended upon for insulation. The glaze shall be smooth, uniform and of Brown shade and shall cover completely all exposed porcelain in parts of the insulator. The shells shall possess the qualities best adopted to insulators for service at extra and ultra high voltages.

Metal fittings of drop forged steel or heat treated malleable cast iron for insulators are required to have excellent mechanical properties such as strength, toughness, high corrosion resistance, free from corona effects, etc.

Cement used in the construction of insulators, particularly for joining the metal parts with the porcelain insulator, shall not cause fracture by expansion or loosening by contraction and must have high compression and shearing strengths and be free from change in volume due to ageing and temperature changes. The thickness of the cement shall be kept as less as possible, however without affecting the strength of the joint and proper care shall be taken to correctly fix the individual parts. The cement shall not give rise to chemical reaction with the metal fittings and/or thermal instability or chemical changes either in the porcelain insulator or the metal parts themselves.

Galvanised steel parts shall be made from high quality steel produced by either acidic or

basic open hearth process, electric furnace process or basic oxygen process. All the properties of the steel castings and hard drawn shall conform to the relevant standards.

The zinc used for galvanising shall be electrolytic high grade Zinc, Zn-98, not less than 98 percent purity. It shall conform to and satisfy all the requirements of relevant ISS, BSS or other Standards to be specified with the due justification. Galvanising has to be done hot dip galvanising process.

The bidder should specify the source of raw materials along with the proof of last purchases made. GEB / Consultant / Client may reject the tender of the Bidders whose raw material suppliers are found to be supplying any poor quality or non standard materials, to the purchaser of this Specification or any other purchaser.

1.2 Freedom from defects

The products shall be smooth and free from all imperfections such as spills, splits, slag inclusion, die marks, scratches, fittings, blow-holes, projections, looseness, overlapping of layers, chipping of porcelain layers, cracks, shrinks, sand, etc. and all such other defects which may hamper the mechanical & electrical properties of the insulator as also the installation of the same at the site etc. Special care should be taken to keep away dirt, grit etc. during manufacturing.

1.3 sizes

1.3.1 Nominal size and tolerances

The porcelain and galvanised steel parts for the complete insulator covered by this standard shall have dimensions specified in this Specification and shall be within the tolerances indicated therein. The dimensions of the steel galvanised parts shall be measured over the zinc coating.

1.4 Joints in insulator & Parts

1.4.1 Porcelain parts

No joints shall be permitted in the porcelain parts in the insulators, in addition to those made in the base materials before final production.

There shall be no joints in steel parts forming the fixing parts (core for mechanical strength) of the insulator.

The steel used in the construction of galvanised steel insulator parts before and after putting in position shall satisfy all the relevant requirements as per the standards indicated or any other standards with due justification.

The zinc used for galvanising shall be electrolytic high grade Zinc. It shall conform to and satisfy all the requirements of relevant standards indicated or any other standards with due justification. Galvanising shall be done by hot dip galvanising process.

The insulators offered shall be suitable for employing Hot Line Maintenance Techniques with the required speed, ease, and safety..

1.5 Marking

Each insulators shall be legibly and indelibly marked with the trade mark of manufacturer, the batch and year of manufacture, guaranteed Electrical & Mechanical strength and the country of manufacture. Such marking on the porcelain shall be printed or embossed and shall be applied before firing. The unit of E&M strength viz. 'Kg.' should be given to facilitate easy identification and to ensure correct use.

1.6 Standard packing

All insulator discs shall be packed in strong wooden crates and boxes of approved design with steel hoop and bends for strength and durability to with stand rough handling during transport and storage.

All crates shall have a tin label which shall indicate all the details like batch number, make, date of manufacture, consignee, destination, quantity, serial numbers etc.

The standard packing of the 90 KN A/F disc insulator shall be 3 nos. per crate.

The total nos. maximum that will be acceptable will be in the next full crate of the ordered quantity and minimum acceptable quantity will be one full crate less than the ordered quantity specified.

The purchaser reserves the right to place orders for the above quantity to the extent of 50% of the total ordered quantity on the same terms and conditions applicable for the standard quantities during the pendency of the contract.

1.7 Tests :

The type, acceptance, routine tests, any tests specifically demanded by the Purchaser and tests during manufacture shall be carried out on the conductor free of cost.

Type tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this specification. These tests shall be carried out on samples prior to commencement of commercial production against the order. The Bidder shall indicate his schedule for carrying out these tests in the activity schedule. These tests shall have to be carried out at the Government Approved Testing Laboratory only in presence of the Purchaser's representative. Purchaser reserves the right to specify the name of the laboratory also, if so felt.

Acceptance Tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-despatch inspection, for the purposes of acceptance of that lot. These tests shall be carried out at the manufacturer's works in presence of Purchaser's representative before the despatch of the materials to the site.

Routine Tests shall mean those tests which are to be carried out on each of the insulator to check requirements which are likely to vary during production. These tests shall be carried out by the manufacturer on each insulator and shall have to furnish these reports to the Purchaser's representative during his visit for acceptance tests.

Tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the supplier to ensure the desired quality of the end product to be supplied by him, including all Quality Control checks and Raw Materials testing.

The standards to which these tests will be carried out are listed against them. Where a

particular test is a specific requirement of this specification, the norms and procedures of the test shall be as specified in specification or as mutually agreed between the Bidder and the purchaser in the Quality Assurance Programme.

For all type and acceptance tests, the acceptance values shall be the values guaranteed by the Bidder in the "Guaranteed Technical Particulars ", of his proposal or the acceptance value specified in this specification, whichever is more stringent for that particular test.

1.8 Type tests

The following necessary type test will have to be carried out . The type test which are more than 05 (Five) years old will not be considered on both Insulators & Metallic:-

a) Visual Examination :
b) Verification of Dimensions
c) Visible Discharge test
d) Impulse Withstand Test For Positive And Negative Wave
e) Impulse Flashover Test For Positive And Negative Wave
f) Dry And Wet Power Frequency Voltage Withstand test For One Minute
g) Dry And Wet Power Frequency Flashover Test.
h) Temperature Cycle Test On First Insulator
i) Mechanical Performance Test
j) Electro Mechanical Failing Load Test
k) Porosity Test On Second Insulator
l) Puncture Test
m) Galvanising Test

All the above Electrical and Mechanical tests shall have to be carried out on minimum three samples of each size and capacity of the insulators from the first lot offered at the third party Government Approved testing laboratory as per relevant clause.

1.9 Acceptance tests

a) Visual and dimensional check
b) Temperature Cycle Test
c) Mechanical Performance Test
d) Electro Mechanical Failing Load Test
e) Puncture Test
f) Porosity Test
g) Galvanising Test

1.10 Routine tests

a) Check that there are no cuts, fins etc. on the insulators.
b) Check that crates are as per specification.
c) Visual Examination
d) Mechanical Routine Tests
e) Electrical Routine Tests
f) All acceptance tests as mentioned in Clause 12.1.3 above shall be carried out on each lot

1.11 Test during manufacture

a. Chemical analysis of zinc used for galvanizing : As Per Relevant standards
b. Chemical analysis Porcelain : - D O -
c. Chemical analysis of steel used : - D O -

TECHNICAL SPECIFICATION FOR EARTHING SYSTEM

EARTHING SYSTEM

1.0 Earth Station

Earth station shall be provided in accordance with standards

1.1 Pipe Electrode Earthing

Earth electrode shall be of minimum 40mm dia class “B” GI Pipe 3.0 m long with tapered bottom and 12mm dia holes at 75mmc/c on all sides for bottom 2.0 m with top watering arrangement.

1.1.1 Plate Electrode

600x600x6mm GI plates with 25mm dia watering pipe with funnel buried at a depth of 2.5 m forms earth electrode. Earthing strip is directly brought to chamber/ disconnecting link in protective pipe.

Earth electrode shall be back filled with alternate layers of charcoal and salt are provided through out height of electrode with overall 300mm cover

1.1.2 Masonry Chamber

Brick masonry chamber of size 450x450x450mm with heavy duty cast iron cover and frame with top at ground level are provided for watering arrangement.

1.1.3 Artificial Soil Treatment

In case of rockery soil or hard moorum, soil resistance is very high, for getting proper earth continuity, Artificial soil treatment shall provided to achieve the required level of lower resistance as per standards.

The earth resistance shall not exceed 2.0 ohms in any case. Accordingly the earth pits to be increased to match this value.

Section 8. Particular Specifications

(None)

Section 9. Drawings

Notes on Drawings

74.

Insert here a list of Drawings. The actual Drawings, including site plans, should be attached to this section or annexed in a separate folder. The Drawings shall be dated, numbered and show the revision number.

75.

Following drawing of 33 kv transmission network and MRSS attached

- *33 kV over head transmission line alignment drawing*
- *33kV OVER HEAD TRANSMISSION NOTES*
- *33 kV Substation layout*
- *33 kV Substation Earthing layout*
- *33 kV Single line diagram*
- *Legends and Notes*
- *33 kV OHT line typical cross sections*
- *Typical earth pit details*

Section 10. Environmental Management Plan

Project activity	Potential impact	Proposed mitigation measure	Parameter to be monitored
Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection seeking to minimize ground disturbance.	Construction techniques and machinery
Physical construction	Disturbed local activities	Construction activities to be planned to to avoid disturbance local activities	Timing of start of construction
Mechanized construction	Noise, vibration and operator safety, efficient operation	Construction equipment to be well maintained.	Construction equipment – estimated noise emissions
Construction of roads for accessibility	Increase in airborne dust particles	Existing roads and tracks used for construction and maintenance access to the line wherever possible.	Access roads, routes (length and width of new access roads to be constructed)
	Increased land requirement for temporary accessibility	New access ways restricted to a single carriageway width within the RoW.	Access width (meters)
Construction activities	Safety of local communities	Coordination with local communities for construction schedules, Barricading the construction area and spreading awareness among locals	Periodic and regular reporting /supervision of safety arrangement
	Local traffic obstruction	Coordination with local authority/ requisite permission for smooth flow of traffic	Traffic flow (Interruption of traffic)
Temporary blockage of utilities	Overflows, reduced discharge	Measure in place to avoid dumping of fill materials in sensitive drainage area	Temporary fill placement (m^3)
Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m^2)
		No use of herbicides and pesticides	
Trimming /cutting of trees within RoW	Fire hazards	Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in meters)
	Loss of vegetation and deforestation	Trees that can survive pruning to comply should be pruned instead of cleared.	Species-specific tree retention as approved by statutory authorities
		Felled trees and other cleared or pruned vegetation to be disposed of as authorized by the statutory bodies.	Disposal of cleared vegetation as approved by the statutory authorities (area cleared in m^2)
Wood/ vegetation	Loss of vegetation and	Construction workers prohibited from harvesting wood in the project area	Illegal wood /vegetation harvesting (area in m^2,

harvesting	deforestation	during their employment, (apart from locally employed staff continuing current legal activities)	number of incidents reported)
Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Soil excavated from tower footings disposed of by placement along roadsides, or at nearby house blocks if requested by landowners	Soil disposal locations and volume (m^3)
Substation construction	Loss of soil	Fill for the substation foundations obtained by creating or improving local water supply ponds or drains, with agreement of local communities	Borrow area sitting (area of site in m^2 and estimated volume in m^2)
	Water pollution	Construction activities involving significan ground disturbance (i.e. substation land forming) not undertaken during the monsoon season	Seasonal start and finish of major earthworks(P^H , BOD/ COD, Suspended solids, others)
Site clearance	Vegetation	Tree clearances for easement establishment to only involve cutting trees off at ground level or pruning as appropriate, with tree stumps and roots left in place and ground cover left undisturbed	Ground disturbance during vegetation clearance (area, m^2)
			Statutory approvals
Tower erection disposal of surplus earthwork/fill	Waste disposal	Excess fill from tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowner	Location and amount (m^3)of fill disposal
Storage of chemicals and materials	Contamination of receptors (land, water, air)	Fuel and other hazardous materials securely stored above high flood level.	Location of hazardous material storage; spill reports (type of material spilled, amount (kg or m^3) and action taken to control and clean up spill)
Construction schedules	Noise nuisance to neighbouring properties	Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [Db(A)])
Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities
Influx of migratory workers	Conflict with local population to share local resources	Using local workers for appropriate tasks	Avoidance/reduction of conflict through enhancement/ augmentation of resource requirements
Uncontrolled erosion/silt runoff	Soil loss, downstream siltation	Need for access tracks minimised, use of existing roads.	Design basis and construction procedures (suspended solids in receiving waters; area re-vegetated in m^2; amount of bunds
		Limit site clearing to work areas	
		Regeneration of vegetation to stabilise works areas on completion (where applicable)	

		Avoidance of excavation in wet season	constructed [length in meter, area in m^2, or volume in m^3])
		Water courses protected from siltation through use of bunds and sediment ponds	
Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices.	Contract clauses
		1.1.a.i.1.1.1.1.1 As much as possible	1.1.a.i.1.1.1.1.2 Desig
		1.1.a.i.1.1.1.1.3 Productive land will be reinstated following completion	1.1.a.i.1.1.1.1.4 Reins tatem ent of
Flooding hazards due to construction impediments of natural drainage	Flooding and loss of soils, contamination of receptors (land, water)	Avoid natural drainage pattern/ facilities being disturbed/blocked/ diverted by ongoing construction activities	Contract clauses (e.g. suspended solids and BOD/COD in receiving water)
Equipment submerged under flood	Contamination of receptors (land, water)	Equipment stored at secure place above the high flood level(HFL)	Store room level to be above HFL (elevation difference in meters)
Inadequate siting of borrow areas (quarry areas)	Loss of land values	Existing borrow sites will be used to source aggregates, therefore, no need to develop new sources of aggregates	Contract clauses
Health and safety	Injury and sickness of workers and members of the public	Safety equipment's (PPEs) for construction workers	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)
		1.1.a.i.1.1.1.1.5 Contract provisions specifying minimum requirements for construction camps	
		1.1.a.i.1.1.1.1.6 Contractor to prepare and implement a health and safety plan.	
		1.1.a.i.1.1.1.1.7 Contractor to arrange for health and safety training sessions	
Inadequate construction stage monitoring	Likely to maximise damages	Training of environmental monitoring personnel	Training schedules

RESPONSIBILITY OF THE CONTRACTOR RELATED TO ENVIRONMENT

The Contractor shall carry out the project related activities as specified in contract agreement. BEZA shall ensure that contractors take due responsibility to mitigate those negative impacts. Environmental awareness creation, particularly about the direct construction impacts and for the health, pollution and safety issues will be Contractor's responsibility. Consultants' responsibility will be in conformity to the relevant clearance conditions of Department of Environment and other environmental management measures implemented in the civil / infrastructure development works. In addition the contractor shall implement the following measures.

- The Contractor shall take all steps to protect environment and avoid causing damages of water bodies and public nuisances of all types during construction .
- Contractor shall comply with the existing statutes and regulations concerning the execution of works as per requirements of DoE and donor's environmental guidelines.
- Since the project is located in the influence area of Sunder bans, the contractor shall be comply to all the environmental management measures applicable and ensure that no damage is caused to sensitive environment and the flora / fauna of the region.
- Contractor shall be responsible for familiarizing himself with the legislation relating to environmental protection that is relevant to his activities. Reference to rational environmental quality guidelines should be made.
- Contractor shall be responsible for bearing the costs of cleaning up any environmental pollution resulting from his activities if methods for doing that are available and effective.
- Precautionary signboards /danger signals/ propitiatory billboards shall be placed in appropriate places to notify people about the possible dangers.
- Contractor in case of surface water pollution from his activities shall take adequate prevention measures not to pollute water and in case pollution of surface water occurred he shall be liable to revert the original quality of water particularly so where surface water has potential use. Cost both for tests and purification shall be borne by Contractor.
- Where water abstraction from boreholes dug by the Contractor results in adverse affects on groundwater that at the time of commencement of contract was being used by local people Contractor under the situation shall ensure supply of equivalent quantity of safe water to the users.
- Contractor shall at all times maintain the camp and construction sites under his control in clean and tidy conditions and shall provide appropriate and adequate facilities for temporary dumping all types of wastes before disposed properly.
- Remove equipment, surplus material, rubbish and temporary works and leave the site in a clean condition to the satisfaction of the company's representatives after completion of construction activities.
- Be responsible to pay compensation upon the appropriate monetary evaluation applicable to the local market if any damage is incurred to agricultural land or surrounding homesteads outside of the requisitioned land
- Contractor shall be responsible for safe transportation and disposal of all types wastes generated out of his activities in a manner so that no environmental pollution or hazard to health is caused to the workers and local people. In case any third party is employed to dispose of wastes, Contractor shall even in such case be considered as if he has discharged the responsibilities himself under this Clause until the wastes leave the site under his control. He remains legally bound to exercise due diligence to ascertain that the proposed transport and disposal mechanism do not cause pollution or public health hazards.
- Contractor shall not allow waste oil, lubricant or other petroleum derivatives to be used as dust suppressants and shall take all reasonable precautions to prevent accidental spillage of petroleum products, contact of such materials with soil or water course through discharge, run-off and seepage.
- Contractor shall be responsible for provision of adequate sanitary facilities to the construction workers (including those employed under subcontract) at construction sites, office and camp sites. He shall not knowingly allow discharge of any untreated sanitary waste to the ground or surface water. Before mobilization of construction workforce, Contractor shall provide details of sanitary and drainage arrangements to the Engineering Representative (ER) for approval. The detail should include maintenance and operation plans and sufficient other information to allow the ER to assess whether or not the proposed facilities are adequate.
- All vehicles and plant operated by the Contractor (including subcontractor) shall be maintained according to manufacturers' specification and their original manual, particularly regarding control

of noise and/or smoke emission. The ER shall reserve the right to ask the Contractor for replacement or rectification of any vehicle or plant within 48 hours that he believes emits excessive noise and/or smoke by serving a notice in writing.

- Contractor shall make every reasonable effort to reduce noise pollution caused by construction activities including relocation of crusher and ancillary plant at new site where the distance between these plants and residential sites is safer for attenuation of noise in the existing residential areas.
- Contractor shall take all reasonable measures to minimize dust-blowing from sites under his control by spraying water on stockpile, bare soil, haul road, un-surfaced traffic route and any other source of dust when conditions require dust suppression. If the ER considers dust suppression measures adopted by Contractor ineffective, Contractor shall in that case take further measure to minimize dust blowing at construction site as per his direction.
- In case any traffic disruption is caused due to construction activities of the Contractor (or subcontractors), Contractor shall in that case be responsible to provide alternative road access to for operational use by vehicles. The facilities provided shall be such that neither of the parties is disturbed by the arrangement.
- In case of any road damage by Contractor (or subcontractor), the Contractor shall notify the ER of it and shall repair the road to its original condition at his own cost.
- In case of any damage caused to agriculture or to the surrounding homesteads outside the ROW either permanently or temporarily by the Contractor or Subcontractor's activities, Contractor shall in such case remain responsible to pay monetary compensation for the damage appropriate to the local market value.
- The Contractor on completion of the Contract shall remove the equipment, surplus materials, and rubbish and temporary structures of all types and shall leave sites in clean condition to the satisfaction of local people and the ER.