



NORTHERN ELECTRICITY SUPPLY PLC

Tender Document

FOR

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with 4D(5mX5m) Bay extension at Sherpur Grid, Bogura on Turnkey Basis.”

Invitation Ref No : 27.29.0000.012.07.064.25- 501
Issued on : 26/06/2025
Tender Package No : GR-40

One Stage Two Envelope Tendering Method (OSTETM), NCT

NORTHERN ELECTRICITY SUPPLY PLC
(An Enterprise of Bangladesh Power Development Board)

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নর্দান ইলেকট্রিসিটি সাপ্লাই পিএলসি

Northern Electricity Supply PLC

(An Enterprise of Bangladesh Power Development Board)

তত্ত্বাবধায়ক প্রকৌশলী (ক্রয়) এর দপ্তর, প্রধান কার্যালয়, বিদ্যুৎ ভবন, হেতেম খাঁ, রাজশাহী-৬০০০

www.nesco.gov.bd

Memo No: 27.29.0000.012.07.064.25- 501

Date: 26/06/2025

INVITATION FOR TENDER

1	Ministry / Division	Power Division, Ministry of Power, Energy & Mineral Resources.			
2	Agency	Northern Electricity Supply PLC			
3	Procuring Entity Name	Superintending Engineer (Procurement)			
4	Procuring Entity Code	Not Used			
5	Procuring Entity District	Rajshahi			
6	Invitation for	Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with 4D(5mX5m) Bay extension at Sherpur Grid, Bogura on Turnkey Basis.			
7	Invitation Ref. No.	27.29.0000.012.07.064.25-501			
8	Date	26/06/2025			
KEY INFORMATION					
9	Procurement Method	One Stage Two Envelope Tendering Method (OSTETM-NCT)			
FUNDING INFORMATION					
10	Budget and Source of Funds	Own fund of NESCO			
11	Development Partners (if applicable)	N/A			
PARTICULAR INFORMATION					
12	Project / Program Code (if applicable)	N/A			
13	Project / Program Name (if applicable)	N/A			
14	Tender Package No	GR-40			
15	Tender Package Name	Same as SI No. 6			
16	Tender Publication Date	26/06/2025			
17	Last Date and time for Selling the tender document	06/08/2025 up to 5:00 PM (BST)			
18	Last Date & Time for Submission of Tender	07/08/2025 11:00 AM (BST)			
19	Tender Opening Date & Time	07/08/2025 11:30 AM (BST)			
20	Name and Address of the office(s) - Selling Tender Document - Receiving Tender Document - Opening Tender Document	Superintending Engineer (Procurement), NESCO., 3 rd Floor, Bidyut Bhaban, Hetem Khan, Rajshahi.			
21	Place/Date/Time of Pre-Tender Meeting	As per Tender Document.			
INFORMATION FOR TENDERER					
22	Eligibility of Tenderer	As per Tender Document.			
23	Brief Description of Goods	Same as SI No. 6			
24	Brief Description of Related services	Same as SI No. 6			
25	Price of Tender Document	TK 4,000/= (Four Thousand) to be paid in the form of Bank Draft / Pay order (Non-refundable) in favor of “Manager (Accounts), RAO, NESCO, Rajshahi”			
26	Package No.	Identification of Package	Location	Tender Security Amount	Completion Time
	GR-40	Same as SI No. 6	Sherpur 132/33 kV Grid Substation, Bogura	As per Tender Document.	365 Days from the date of Contract
PROCURING ENTITY DETAILS					
27	Name of Official Inviting the Tender	Md. Rabiul Islam			
28	Designation of Official Inviting Tender	Superintending Engineer			
29	Address of Official Inviting the Tender	Procurement Department, NESCO, Bidyut Bhaban, Hetem Khan, Rajshahi			
30	Contact details of Official Inviting the Tender:	Tel: +880-1709-996752, E-mail: se.procurement@nesco.gov.bd			
31	The Procuring entity reserves the right to accept or reject any/all tenders prior to acceptance without assigning any reason what so ever.				


26-6-25
(Md. Rabiul Islam)
Superintending Engineer

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Section 1. Instructions to Tenderers	
A. General	
1. Scope of Tender	1.1 The Purchaser named in the Tender Data Sheet (TDS) (hereinafter referred to as the “Purchaser”) wishes to issue these Tender Documents for the supply and installation of plant & equipment incidental thereto, as specified in the TDS and as detailed in Section 6: Employer’s Requirements.
	1.2 The name of the Tender and the number and identification of its constituent lot(s) are stated in the TDS .
	1.3 Unless otherwise stated, throughout this Tender Document definitions and interpretations shall be as prescribed in the Section 3: General Conditions of Contract.
2. Interpretation	2.1 Throughout this Tender Document (a) the term “in writing” means communication written by hand or machine duly signed and includes properly authenticated messages by facsimile or electronic mail; (b) if the context so requires, singular means plural and vice versa; and (c) “day” means calendar days unless otherwise specified as working days; (d) "Tender Document ", means the Document provided by a Purchaser to a Tenderer as a basis for preparation of its Tender; (e) "Tender ", depending on the context, means a Tender submitted by a Tenderer for delivery of Goods and Related Services to a Purchaser in response to an Invitation for Tender ;
3. Source of Funds	3.1 The Purchaser has been allocated public funds from the source as indicated in the TDS and intends to apply a portion of the funds to eligible payments under the contract for which this Tender Document is issued.
	3.2 For the purpose of this provision, “ public funds ” means any funds allocated to a Purchaser under Government budget, or loan, grants and credits placed at the disposal of a Purchaser through the Government by the development partners or foreign states or organizations.
	3.3 Payments by the development partner, if so indicated in the TDS , will be made only at the request of the Government and upon approval by the development partner in accordance with the applicable Loan/Credit/Grant Agreement, and will be subject in all respects to the terms and conditions of that Agreement.

4. Corrupt, Fraudulent, Collusive, Coercive (or Obstructive in case of Development Partner) Practices	4.1 The Government and the Development Partner, if applicable requires that the Procuring Entity as well as the Tenderers and Contracts (including , sub-contractors, agents, personnel, consultants, and service providers) shall observe the highest standard of ethics during implementation of procurement proceedings and the execution of Contracts under public funds. 4.2 For the purposes of ITT Sub Clause 4.3, the terms set forth below as follows: (a) “corrupt practice” means offering, giving or promising to give, receiving, or soliciting either directly or indirectly, to any officer or employee of the Procuring Entity or other public or private authority or individual, a gratuity in any form; employment or any other thing or service of value as an inducement with respect to an act or decision or method followed by the Procuring Entity in connection with a Procurement proceeding or Contract execution; (b) “fraudulent practice” means the misrepresentation or omission of facts in order to influence a decision to be taken in a Procurement proceeding or Contract execution; (c) “collusive practice” means a scheme or arrangement between two (2) or more Persons, with or without the knowledge of the Procuring Entity, that is designed to arbitrarily reduce the number of Tenders submitted or fix Tender prices at artificial, non-competitive levels, thereby denying the Procuring Entity the benefits of competitive price arising from genuine and open competition; (d) “coercive practice” means harming or threatening to harm, directly or indirectly, Persons or their property to influence a decision to be taken in the Procurement proceeding or the execution of a Contract, and this will include creating obstructions in the normal submission process used for Tenders. (e) “Obstructive practice” (applicable in case of Development Partner) means deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and /or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation. 4.3 Should any corrupt, fraudulent, collusive, coercive (or obstructive in case of Development Partner) practice of any kind is determined by the Procuring Entity or the Development Partner, if applicable, this will be dealt in accordance with the provisions of the Public Procurement Act and Rules and Guidelines of the Development Partners as stated in the ITT sub-clause 3.3.

	In case of obstructive practice, this will be dealt in accordance with Development Partners Guidelines.
	4.4 If corrupt, fraudulent, collusive, coercive (or obstructive in case of Development Partner) practices of any kind is determined by the Procuring Entity against any Tenderer or Contracts (including sub-contractors, agents, personnel, consultants, and service providers) in competing for, or in executing, a contract under public fund: (a) Procuring Entity and/or the Development Partner shall exclude the concerned Tenderer from further participation in the concerned procurement proceedings; (b) Procuring Entity and/or the Development Partner shall reject any recommendation for award that had been proposed for that concerned Tenderer; (c) Procuring Entity and/or the Development Partner shall declare, at its discretion, the concerned Tenderer to be ineligible to participate in further Procurement proceedings, either indefinitely or for a specific period of time; (d) Development Partner shall sanction the concerned Tenderer or individual, at any time, in accordance with prevailing Development Partner' sanctions procedures, including by publicly declaring such Tenderer or individual ineligible, either indefinitely or for a stated period of time: (i) to be awarded a Development Partner-financed contract; and (ii) to be a nominated sub-contractor, consultant, manufacturer or Contractor, or service provider of an otherwise eligible firm being awarded a Development Partner-financed contract; and (e) Development Partner shall cancel the portion of the loan allocated to a contract if it determines at any time that representatives of the Procuring Entity or of a beneficiary of the loan engaged in corrupt, fraudulent, collusive, coercive or obstructive practices during the procurement or the execution of that Development Partner financed contract, without the Procuring Entity having taken timely and appropriate action satisfactory to the Development Partner to remedy the situation. 4.5 Tenderer shall be aware of the provisions on corruption, fraudulence, collusion, coercion (and obstruction, in case of Development Partner) of the Public Procurement Act, 2006, the Public Procurement Rules, 2008 and others as stated in GCC Clause 38. 4.6 In further pursuance of this policy, Tenderers, Contractors and their sub-contractors, agents, personnel, consultants, service providers shall permit the Government and the Development Partner to inspect any accounts and records and other documents relating to the Tender submission and contract performance, and to have them audited by auditors appointed by the Government and/or the Development Partner during the procurement or the execution of that Development Partner financed contract.

5. Eligible Tenderers	5.1 This Invitation for Tenders is open to all potential Tenderers from all countries, except for any specified in the TDS. 5.2 Tenderers shall have the legal capacity to enter into the Contract under the Applicable law. 5.3 Tenderers shall be enrolled in the relevant professional or trade organisations registered in Bangladesh. 5.4 Tenderers may be a physical or juridical individual or body of individuals, or company, association or any combination of them in the form of a Joint Venture(JV) invited to take part in public procurement or seeking to be so invited or submitting a Tender in response to an Invitation for Tenders. 5.5 Tenderers shall have fulfilled its obligations to pay taxes and social security contributions under the provisions of laws and regulations of the country of its origin. 5.6 Tenderers should not be associated, or have been associated in the past, directly or indirectly, with a consultant or any of its affiliates which have been engaged by the Procuring Entity to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the works to be performed under this Invitation for Tenders. 5.7 Tenderers in its own name or its other names or also in the case of its Persons in different names shall not be under a declaration of ineligibility for corrupt, fraudulent, collusive or coercive practices as stated under ITT Sub Clause 4.4 (or obstructive practice, in case of Development Partner) in relation to the Development Partner's Guidelines in projects financed by Development Partner. 5.8 Tenderers are not restrained or barred from participating in Public Procurement on grounds of poor performance in the past under any Contract. 5.9 Tenderers shall not be insolvent, be in receivership, be bankrupt, be in the process of bankruptcy, be not temporarily barred from undertaking business and it shall not be the subject of legal proceedings for any of the foregoing. 5.10 Government-owned enterprise in Bangladesh may also participate in the Tender if it is legally and financially autonomous, it operates under commercial law, and it is not a dependent agency of the Procuring Entity. 5.11 Tenderers shall provide such evidence of their continued eligibility satisfactory to the Procuring Entity, as the Procuring Entity will reasonably request. 5.12 These above requirements for eligibility will extend, as applicable, to each JV partner and Subcontractor proposed by the Tenderers. 5.13 Tenderers shall have the up-to-date valid license(s), issued by the corresponding competent authority, as specified in the TDS.

6. Eligible Plant and Services	6.1	The plant and services to be supplied under the contract are eligible, unless their origin is from a country specified in the TDS and all expenditures under the contract will be limited to such plant, and services.
	6.2	For purposes of this Clause, the term “plant” means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided in the facilities; and “installation services” means all those services ancillary to the supply of the Plant for the Facilities, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation, installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training etc
	6.3	For purposes of this clause, “origin” means the place where the plant, or component parts thereof are mined, grown, produced or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially different in its basic characteristics or in purpose or utility from its components or country where the goods have been mined, grown, cultivated, produced, manufactured or processed; or through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.
	6.4	The origin of plant & equipment is distinct from the nationality of the Tenderer. The nationality of the firm that produces, assembles, distributes, or sells the goods shall not determine their origin.
7. Site Visit	7.1	The Tenderer is advised to visit and examine the site where the plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the tender and entering into a contract for the provision of Plant and Installation Services.
	7.2	The Tenderer and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Tenderer, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
	7.3	The Tenderer should ensure that the Purchaser is informed of the visit in adequate time to allow it to make appropriate arrangements.
	7.4	The costs of visiting the Site shall be at the Tenderer’s own expense.

B. Tender Document	
8. Tender Document: General	8.1 The Sections comprising the Tender Document are listed below, and should be read in conjunction with any Addendum issued under ITT Clause 11. • Section 1 Instructions to Tenderers (ITT) • Section 2 Tender Data Sheet (TDS) • Section 3 General Conditions of Contract (GCC) • Section 4 Particular Conditions of Contract (PCC) • Section 5 Tender and Contract Forms • Section 6 Employer's Requirements • Section 7 Drawings
	8.2 The Purchaser shall reject any Tender if the Tender Document was not purchased directly from the Purchaser, or through its agent as stated in the TDS .
	8.3 The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document as well as addendum to Tender Documents.
9. Clarification of Tender Document	9.1 A prospective Tenderer requiring any clarification of the Tender Document shall contact the Purchaser in writing at the Purchaser's address indicated in the TDS before two-third of time allowed for preparation and submission of Tender elapses.
	9.2 The Procuring Entity is not obliged to answer any clarification request received after that date as stated under ITT Sub Clause 9.1.
	9.3 The Procuring Entity shall respond in writing within five (5) working days of receipt of any such request for clarification received under ITT Sub Clause 9.1.
	9.4 The Procuring Entity shall forward copies of its response to all those who have purchased the Tender Document, including a description of the enquiry but without identifying its source.
	9.5 Should the Procuring Entity deem it necessary to revise the Tender Document as a result of a clarification, it will do so following the procedure under ITT Clause 11.
10. Pre-Tender Meeting	10.1 To clarify issues and to answer questions on any matter arising in the Tender Document, the Purchaser may, if stated in the TDS , hold a Pre-Tender Meeting at the place, date and time as specified in the TDS. All Potential Tenderers are encouraged to attend the meeting, if it is held.
	10.2 Minutes of the pre-Tender meeting, including the text of the questions raised and the responses given, together with any responses prepared after the meeting, will be transmitted within one week (7 days) after holding the meeting to all those who purchased the Tender Document and even those who did not attend the meeting.

	10.3 Any amendment to the Tender Documents listed in ITT Sub-Clause 8.1 that may become necessary as a result of the pre-Tender meeting shall be made by the Purchaser exclusively through the issue of an Addendum as stated under ITT Sub-Clause 11 and not through the minutes of the pre-Tender meeting. 10.4 Non-attendance at the Pre-Tender meeting will not be a cause for disqualification of a Tenderer.
11. Addendum to Tender Document	11.1 At any time prior to the deadline for submission of Tenders, the Purchaser on its own initiative or in response to a clarification request in writing from a Tenderer, having purchased the Tender Document or as a result of a Pre-Tender meeting, may revise the Tender Document by issuing an addendum pursuant to Rule 95 of the Public Procurement Rules, 2008. 11.2 The addendum issued under ITT Sub-Clause 11.1 shall become an integral part of the Tender Document and shall have a date and an issue number and shall be circulated by fax, mail or e-mail, to Tenderers who have purchased the Tender Documents within five (5) working days of issuance of such addendum, to enable Tenderers to take appropriate action. 11.3 The Tenderer shall acknowledge receipt of an addendum. 11.4 Tenderers who have purchased the Tender Documents but have not received any addendum issued under ITT Sub-clause 11.1 shall inform the Purchaser of the fact by fax, mail or e-mail before two-third of the time allowed for the submission of Tenders has elapsed. 11.5 Procuring Entities shall also ensure posting of relevant addenda with the reference number and date on their website. 11.6 To give a prospective Tenderer reasonable time in which to take an amendment into account in preparing its Tender, the Purchaser may, at its discretion, extend the deadline for the submission of Tenders, pursuant to Rule 95(6) of the Public Procurement Rule, 2008 and under ITT Clause 36. 11.7 If an addendum is issued when time remaining is less than one-third of the time allowed for the preparation of Tenders, a Purchaser shall extend the deadline by an appropriate number of days for the submission of Tenders, depending upon the nature of the Procurement requirement and the addendum. The minimum time for such extension shall not be less than seven (7) days.
C. Qualification Criteria	
12. General Criteria	12.1 The Tenderer shall possess the necessary professional and technical qualifications and competence, financial resources, equipment and other physical facilities, managerial capability, specific experience, reputation, and the personnel, to perform the contract.

	12.2 In addition to meeting the eligibility criteria, as stated in ITT Clause 5, the Tenderer must satisfy the other criteria stated in ITT Clauses 13 to 15 inclusive. 12.3 To qualify for multiple number of contracts/lots in a package made up of this and other individual contracts/lots for which tenders are invited in the Invitation for Tenders, the Tenderer shall demonstrate having resources and experience sufficient to meet the aggregate of the qualifying criteria for the individual contracts.
13. Litigation History	13.1 The maximum number of arbitration awards against the Tenderer over a period shall be as specified in the TDS .
14. Experience Criteria	14.1 Tenderers shall have the following minimum level of supply experience to qualify for supplying the Plant and Services under the contract: (a) a minimum number of years of general experience in the role of Contractor or Subcontractor or Management Contractor as specified in the TDS; and (b) Specific experience as a Contractor or Subcontractor or Management Contractor that are similar to the proposed plant and services in at least a number of contract(s) and of a minimum value over the period, as specified in the TDS.
15. Financial Criteria	15.1 Tenderers shall have the following minimum level of financial capacity of qualify for the supply, execution and performance of plant and services under the contract. (a) the average annual turnover as specified in the TDS calculated as total certified payments received for contracts in progress or completed, during the period specified in the TDS; (b) availability of minimum liquid assets or working capital or credit facilities, as specified in the TDS; and; (c) satisfactory resolution of all claims, arbitrations or other litigation cases and shall not have serious negative impact on the financial capacity of the Tenderer.
16. Personnel Capacity	16.1 The Tenderer shall have the following minimum level of personnel capacity to qualify for the performance of the plant and services under the Contract. A Project Manager, Engineers, and other key staff with qualifications and experience as specified in the TDS;
17. Equipment Capacity	17.1 The Tenderer shall own suitable equipment and other physical facilities or have proven access through contractual arrangement to hire or lease such equipment or facilities for the desired period, where necessary or have assured access through lease, hire, or other such method, of the essential equipment, in full working order, as specified in the TDS .

18. Joint Venture, Consortium or Association	18.1	The Tenderer may participate in the procurement proceedings forming a Joint Venture, Consortium or Associations (JVCA) by an agreement, executed case by case on a non judicial stamp of value as stated in TDS or alternately with the intent to enter into such an agreement supported by a Letter of Intent along with the proposed agreement duly signed by all partners of the intended JVCA and authenticated by a Notary Public.
	18.2	The figures for each of the partners of a JVCA shall be added together to determine the Tenderer's compliance with the minimum qualifying criteria; however, for a JVCA to qualify, lead partner and its other partners must meet the criteria stated in the TDS . Failure to comply with these requirements will result in rejection of the JVCA Tender. Subcontractors' experience and resources will not be taken into account in determining the Tenderer's compliance with the qualifying criteria.
	18.3	Each partner of the JVCA shall be jointly and severally liable for the execution of the Contract, all liabilities and ethical and legal obligations in accordance with the Contract terms.
	18.4	The JVCA shall nominate a Representative (partner-in-charge/Lead Firm) who shall have the authority to conduct all business for and on behalf of any and all the partners of the JVCA during the tendering process and, in the event the JVCA is awarded the Contract, during contract execution including the receipt of payments for and on behalf of the JVCA.
	18.5	Each partner of the JVCA shall complete the JVCA Partner Information (Form PG5A-2b) for submission with the Tender
19. Subcontractor(s)	19.1	Tenderer, pursuant to Rule 53 of the PPR2008, is allowed to sub-contract a portion of the Supply.
	19.2	The Tenderer shall specify in its Tender all portion of the Plant and Services that will be subcontracted, if any, including the entity(ies) to whom each portion will be subcontracted to, subject to the maximum allowable limit for subcontracting of Plant and Services specified in the TDS .
	19.3	The Purchaser may require Tenderers to provide more information about their subcontracting arrangements. If any Subcontractor is found ineligible or unsuitable to carry out the subcontracted tasks, the Procuring Entity may request the Tenderer to propose an acceptable substitute.
	19.4	The Purchaser may also select nominated Subcontractor(s) to execute certain specific components of the Works and if so, those will be specified in the TDS .
	19.5	The successful Tenderer shall under no circumstances assign the goods/works/services or any part of it to a Subcontractor
	19.6	Subcontractors must comply with the provision of ITT Clause 5. For this purpose contractor shall complete the Subcontractor's information in Form PG5A-2c for submission with tender

	19.7	If the Purchaser determines that a subcontractor is ineligible, the subcontracting of such portion of the Plants and Services assigned to the ineligible subcontractor shall be disallowed
D. Tender Preparation		
20. Only one Tender	20.1	If a Tender for Plant and Services is invited on 'lot-by-lot' basis, each lot shall constitute a tender. A Tenderer shall submit only one (1) Tender for each lot, either individually or as a JVCA. The Tenderer who submits or participates in more than one (1) Tender for each lot will cause all the Tenders with that Tenderer's participation to be rejected.
21. Cost of Tendering	21.1	Tenderers shall bear all costs associated with the preparation and submission of its Tender, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Tendering process.
22. Issuance and Sale of Tender Document	22.1	A Purchaser, pursuant to Rule 94 of the Public Procurement Rules, 2008 shall make Tender Documents available immediately to the potential Tenderers, requesting and willing to purchase at the corresponding price if the advertisement has been published in the newspaper pursuant to Rule 90 of the Public Procurement Rules, 2008.
	22.2	Full contact details with mailing address, telephone and facsimile numbers and electronic mail address, as applicable, of those to whom Tender Documents have been issued shall be recorded with a reference number by the Purchaser or its agent.
	22.3	There shall not be any pre-conditions whatsoever, for sale of Tender Document and the sale of such Document shall be permitted up to the day prior to the day of deadline for the submission of Tender.
23. Language of Tender	23.1	Tenders shall be written in the English language. Correspondences and documents relating to the Tender may be written in English or <i>Bangla</i> . Supporting documents and printed literature furnished by the Tenderers that are part of the Tender may be in another language, provided they are accompanied by an accurate translation of the relevant passages in the English or <i>Bangla</i> language, in which case, for purposes of interpretation of the Tender, such translation shall govern.
	23.2	Tenderers shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.
24. Contents of Tender (Document establishing the tender's qualification)	24.1	The Tender prepared by the Tenderers shall comprise Two Envelope submitted simultaneously, one called the Technical Offer (Envelope-01) containing the documents listed in ITT 24.2 and other called the Financial Offer containing the documents listed in 24.3, both envelopes enclosed together in an outer Single envelope.
	24.2	The Technical Offer (Envelope-01) prepared by the Tenderers will comprise the following:

	(a) Technical Submission Letter (Form PG5A-1a) as furnished in Section 5: Tender and Contract Forms. This form must be completed without any alterations to its format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested (b) Tenderer Information Sheet (Form PG5A-2) as furnished in Section 5: Tender and Contract Forms; (c) Tender Security as stated under ITT Clause 32,33 and 34; (d) Technical Proposal (Form PG5A-4) as furnished in Section 5: Tender and Contract Forms. (e) Alternatives, if permitted, as stated under with ITT Clause 25; (f) Written confirmation authorising the signatory of the Tender to commit the Tenderer, as stated under ITT Sub-Clause 37.3; (g) The completed eligibility declarations, to establish its eligibility as stated under ITT Clause 5, in the Tender Submission Sheet (Form PG5A-1a & 1b), as furnished in section 5: Tender and Contract Forms; (h) An affidavit confirming the legal capacity stating that there are no existing orders of any judicial court that prevents either the Tenderer or employees of a Tenderer entering into or signing a Contract with the Purchaser as stated under ITT clause 5; (i) An affidavit confirming that the Tenderer is not insolvent, in receivership or not bankrupt or not in the process of bankruptcy, not temporarily barred from undertaking their business for financial reasons and shall not be the subject of legal proceedings for any of the foregoing as stated under ITT Clause 5; (j) A certificate issued by the competent authority stating that the Tenderer is a Tax payer having valid Tax Identification Number (TIN) and VAT registration number or in lieu any other document acceptable to the Purchaser demonstrating that the Tenderer is a genuine Tax payer and has a VAT registration number as a proof of fulfillment of taxation obligations as stated under ITT Clause 5. In the case of foreign Tenderers, a certificate of competent authority in that country of which the Tenderer is citizen shall be provided ; (k) Documentary evidence demonstrating that they are enrolled in the relevant professional or trade organizations registered in Bangladesh or in case of foreign tenderer in their country of origin or a certificate concerning their competency issued by a professional institution in accordance with the law of the country of their origin, as stated under ITT Clause 5;

	(l) The country of origin declarations, to establish the eligibility of the Plant and Services as stated under ITT Clause 6, in the Price Schedule for Plant and Services (Form PG5A-3) as, applicable, furnished in Section 5: Tender and Contract Forms; (m) Documentary evidence as stated under ITT Clauses 28, that the Goods and Related Services conform to the Tender Documents; (n) Documentary evidence as stated under ITT Clause 29 that the Tenderer's qualifications conform to the Tender Documents; (o) Documents establishing legal and financial autonomy and compliance with commercial law, as stated under ITT Sub-clause 5.3 in case of government owned entity; and (p) In addition to the requirements stated under ITT Sub Clause 18.1, Tenders submitted by a JVCA or proposing a Subcontractor shall include. - 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 - 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; - the JVCA Partner Information (Form PG5A-2b); - the Subcontractor Information (Form PG5A-2c). (q) the completed Specifications Submission and Compliance Sheet (Form PG5A-4a) as stated under ITT clause 28.1; (r) Any other document as specified in the TDS. 24.3 The Financial Offer (Financial Envelope -02) prepared by the Tenderers shall comprise the following: - The Financial offer Submission Letter (Form PG5A-1b) as furnished in Section 5; - The Tenderer shall submit the completed Price Schedule for Plant and Services (Form PG5A-3), according to their origin as appropriate as furnished in section 5: Tender and Contract Forms. - the written confirmation authorizing the signatory of the Tender to commit the Tenderer, as stated under ITT Sub Clause 37.3; - any other document as specified in the TDS.
25. Alternatives	25.1 Unless otherwise stated in the TDS, alternatives shall not be considered.

26. Tender Prices, Discounts & Price adjustment	26.1 Unless otherwise specified in the TDS, tenderers shall quote for the entire Plant and Installation Services on a “single responsibility” basis such that the total tender price covers all the Contractor’s obligations mentioned in or to be reasonably inferred from the tender document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the plant. This includes all requirements under the Contractor’s responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the tender document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Tender Document, all in accordance with the requirements of the General Conditions of Contract. Items against which no price is entered by the Tenderer will not be paid for by the Purchaser when executed and shall be deemed to be covered by the prices for other items. 26.2 Tenderers are required to quote the price for the commercial, contractual and technical obligations outlined in the tender document 26.3 Tenderers shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 5, Tender and Contract Forms. 26.4 Depending on the scope of the Contract, the Price Schedules may comprise up to the six (6) schedules listed below. Separate numbered Schedules included in Section IV, Tender Forms, from those numbered 1-4 below, shall be used for each of the elements of the Plant and Installation Services. The total amount from each Schedule corresponding to an element of the Plant and Installation Services shall be summarized in the schedule titled Grand Summary, (Schedule 5), giving the total tender price(s) to be entered in the Letter of Tender. Schedule No. 1 Plant (including Mandatory Spare Parts) Supplied from Abroad Schedule No. 2 Plant (including Mandatory Spare Parts) Supplied from within the Purchaser’s Country Schedule No. 3 Design Services Schedule No. 4 Civil works part Schedule No. 5 Installation Services Schedule No. 6 Grand Summary (Schedule Nos. 1 to 4) Schedule No. 7 Recommended Spare Parts Tenderers shall note that the plant and equipment included in Schedule Nos. 1 and 2 above exclude materials used for civil, building and other construction works. All such materials shall be included and priced under Schedule No. 4, Installation Services. 26.5 In the Schedules, tenderers shall give the required details and a breakdown of their prices as follows: a) Plant to be supplied from abroad (Schedule No. 1):

	The price of the plant shall be quoted on CIP-named place of destination/CIF basis as specified in the TDS and as applicable. (b) Plant manufactured within the Purchaser's country (Schedule No. 2): i) The price of the plant shall be quoted on an EXW INCOTERM basis (such as "ex-works," "ex-factory," "ex-warehouse" or "off-the-shelf," as applicable), (ii) Sales tax and all other taxes payable in the Employer's country on the plant if the contract is awarded to the Tenderer, and (iii) The total price for the item. (c) Design Services (Schedule No. 3). (d) Installation Services shall be quoted separately (Schedule No. 4) and shall include rates or prices for local transportation to named place of final destination as specified in the TDS, insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the Tender Document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's country as of twenty-eight (28) days prior to the deadline for submission of tenders. (e) Recommended spare parts shall be quoted separately (Schedule 6) as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts 26.6 The current edition of INCOTERMS, published by the International Chamber of Commerce shall govern. 26.7 The prices shall be either fixed or adjustable as specified in the TDS. 26.8 In the case of Fixed Price, prices quoted by the Tenderer shall be fixed during the Tenderer's performance of the contract and not subject to variation on any account. A tender submitted with an adjustable price quotation will be treated as non-responsive and rejected. 26.9 In the case of Adjustable Price, prices quoted by the Tenderer shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport and contractor's equipment in accordance with the procedures specified in the corresponding Appendix to the Contract Agreement. A tender submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. Tenderers are required to indicate the source of labor and material indices in the corresponding Form in Section 5, Tender and Contract Forms

	26.10 If so indicated in ITT 1.2, tenders are to be invited for individual lots or for any combination of lots (packages). Tenderers wishing to offer any price reduction (discount) for the award of more than one lot shall specify in their Tender Submission Letter the price reductions applicable to each package, or alternatively, to individual Contracts within the package, and the manner in which the price reductions will apply. 26.11 Tenderers wishing to offer any unconditional discount shall specify in their Letter of Tender the offered discounts and the manner in which price discounts will apply. 26.12 If so indicated under ITT Sub Clause 26.9, Tenders are being invited with a provision for price adjustments. The unit rates or prices quoted by the Tenderer are subject to adjustment during the performance of the Contract in accordance with the provisions of the relevant GCC Clause and, in such case the Employer shall provide the indexes and weightings or coefficients in Appendix to the Tender for the price adjustment formulae specified in the PCC. 26.13 The Employer may require the Tenderer to justify its proposed indexes, if any of those as stated under ITT Sub Clause 26.12, are instructed to be quoted by the Tenderer in Appendix to the Tender. 26.14 The price adjustment stated under ITT Sub Clause 26.9 and 26.12 shall be dealt with in accordance with the provisions in Section 12 and 22 of the Public Procurement Act, 2006 and Rule 5 and 38 of the Public Procurement Rules, 2008.
27. Tender Currency	27.1 For expenditures that will be incurred in Bangladesh, the Tenderer shall quote the prices in Bangladesh Taka 27.2 Suppliers offering Goods manufactured or assembled in Bangladesh are permitted to submit their Tender in a combination of local and foreign currencies. 27.3 In case of National Tender, all quoted price shall be in local currency. 27.4 In case of international competitive tender, for expenditures that will be incurred outside Bangladesh, the Tenderer may quote the prices as specified in TDS.
28. Documents Establishing the Conformity of Plant, and Services	28.1 To establish the conformity of the plant and services to the Tender Documents, the Tenderer shall furnish as part of its Tender the documentary evidence that the Goods and Related services conform to the technical specifications and standards in Section 6, Employer's Requirement. a. a detailed description of the essential technical and performance characteristics of the plant and services, including the functional guarantees of the proposed plant and services, in response to the Specification

	b. a list giving full particulars, including available sources, of all spare parts and special tools necessary for the proper and continuing functioning of the plant for the period named in the TDS, following completion of plant and services in accordance with provisions of contract; and c. a commentary on the Employer's Specification and adequate evidence demonstrating the substantial responsiveness of the plant and services to those specifications. Tenderers shall note that standards for workmanship, materials and equipment designated by the Employer in the Tender Document are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The Tenderer may substitute alternative standards, brand names and/or catalog numbers in its tender, provided that it demonstrates to the Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Specification.
29. Documents Establishing Eligibility of the Tenderer	29.1 Tenderers, if applying as a sole Tenderer, shall submit documentary evidence to establish its eligibility as stated under ITT Clause 5 and, in particular, it shall: (a) complete the eligibility declarations in the Tender Submission Letter (Form PG5A-1a); (b) complete the Tenderer Information (Form PG5A-2a); (c) complete Subcontractor Information (Form PG5A-2c), if it intends to engage any Subcontractor(s). 29.2 Tenderers, if applying as a partner of an existing or intended JV shall submit documentary evidence to establish its eligibility as stated under ITT Clause 5 and, in particular, in addition to as stated under ITT Sub Clause 29.1, it shall: (a) provide for each JV partner, completed JV Partner Information (Form PG5A-2b); (b) provide the JV agreement or Letter of Intent along with the proposed agreement of the intended JV as stated under ITT Sub Clause 18.1
30. Validity Period of Tender	30.1 Tender validities shall be determined on the basis of the complexity of the Tender and the time needed for its examination, evaluation, approval of the Tender and issuance of the Notification of Award (NOA). 30.2 Tenders shall remain valid for the period specified in the TDS after the date of Tender submission deadline prescribed by the Purchaser, as stated under ITT Clause 39. A Tender valid for a period shorter than that specified will be rejected by the Purchaser as non- responsive.
31. Extension of Tender Validity and Tender Security	31.1 In justified exceptional circumstances, prior to the expiration of the Tender validity period, the Purchaser following Rule 21 of the Public Procurement Rules, 2008 may solicit, not later than ten

	(10) days before the expiry date of the Tender validity, compulsorily all the Tenderers' consent to an extension of the period of validity of their Tenders.
	31.2 The request for extension of Tender validity period shall state the new date of the validity of the Tender.
	31.3 The request from the Purchaser and the responses from the Tenderers will be made in writing.
	31.4 Tenderers consenting in writing to the request made by the Purchaser under ITT Sub-Clause 30.1 shall also correspondingly extend the validity of its Tender Security for twenty-eight (28) days beyond the new date for the expiry of Tender validity.
	31.5 Tenderers consenting in writing to the request under ITT Sub-Clause 31.1 shall not be required or permitted to modify its Tender in any circumstances.
	31.6 If the Tenderers are not consenting in writing to the request made by the Purchaser under ITT Sub-Clause 31.1, its Tender will not be considered for subsequent evaluation.
32. Tender Security	32.1 The Tender Security and its amount shall be determined sufficient to discourage the submission of frivolous and irresponsible tenders pursuant to Rule 22 of the Public Procurement Rule 2008 and shall be expressed as a rounded fixed amount and, shall not be stated as a precise percentage of the estimated total Contract value. 32.2 The Tenderer shall furnish as part of its Technical offer (envelope-1) Tender, in favour of the Purchaser or as otherwise directed on account of the Tenderer, a tender security in original form (not copy) and in the amount as specified in TDS. 32.3 If the Tender is a Joint Venture, the Tenderer shall furnish as part of its Tender, in favour of the Procuring Entity or as otherwise directed on account of the title of the existing or intended JVCA or any of the partners of that JVCA or in the names of all future partners as named in the Letter of Intent of the JVCA, a Tender Security in original form and in the amount as stated under ITT Sub Clause 32.1.
33. Form of Tender security	33.1 The Tender Security shall: (a) In case of NCT, at the Tenderer's option, be either; (i) In the form of a Bank Draft, Pay order or (ii) in the form of an irrevocable bank guarantee issued by any scheduled Bank of Bangladesh, in the format (Form PG5A-6) furnished in Section 5: Tender and Contract Forms. (b) In case of ICT, in the form of an irrevocable bank guarantee issued by an internationally reputable bank and shall require to be endorsed by its any correspondent bank located in Bangladesh, to make it enforceable, in the format (Form PG5A-6) furnished in Section 5: Tender and Contract Forms;

	33.2 Tender security shall be payable promptly upon written demand by the Purchaser in the case of the conditions listed in ITT Clause 36 being invoked; and 33.3 Tender security shall remain valid for at least twenty eight (28) days beyond the expiry date of the Tender Validity in order to make a claim in due course against a Tenderer in the circumstances detailed under ITT Clause 36.
34. Authenticity of Tender Security	34.1 The authenticity of the Tender security submitted by a Tenderer shall be examined and verified by the Purchaser in writing from the Bank issuing the security, prior to finalization of the Evaluation Report pursuant to Rule, 24 of the Public Procurement Rule, 2008. 34.2 If a Tender Security is found to be not authentic, the Tender which it covers shall not be considered for subsequent evaluation and in such case the Purchaser shall proceed to take punitive measures against that Tenderer as stated under ITT Sub-Clause 4.6, pursuant to Rule 127 of the Public Procurement Rules, 2008 and in accordance with Section 64(5) of the Public Procurement Act, 2006. 34.3 Tender not accompanied by a valid Tender Security as stated under Sub-Clause 29, 30 and 31, shall be considered as non-responsive.
35. Return of Tender Security	35.1 No Tender security shall be returned by the Tender Opening Committee (TOC) during and after the opening of the Tenders pursuant to Rule 26 of the Public Procurement Rules 2008. 35.2 No Tender security shall be returned to the Tenderers before contract signing, except to those who are found non-responsive. 35.3 Tender securities of the non-responsive Tenders shall be returned immediately after the Evaluation Report has been approved by the Purchaser. 35.4 Tender securities of the responsive Tenderers shall be returned only after the lowest evaluated responsive Tenderer has submitted the performance security and signed the contract, that being even before the expiration of the validity period specified in Clause 30. 35.5 Tender Securities of the Tenderers not consenting within the specified date in writing to the request made by the Purchaser under ITT Sub-Clause 31.1 in regard to extension of its Tender validity shall be discharged or returned forthwith.
36. Forfeiture of Tender Security.	36.1 The Tender security pursuant to Rule 25 of the Public Procurement Rules, 2008 may be forfeited if a Tenderer: (a) withdraws its Tender after opening of Tenders but within the validity of the Tender as stated under ITT Clauses 30, and 31, pursuant to Rule 19 of the Public Procurement Rules 2008; or (b) refuses to accept a Notification of Award as stated under ITT Sub-Clause 65.3, pursuant to Rule 102 of the Public Procurement Rules 2008; or (c) fails to furnish performance security as stated under ITT Sub-Clause 66.2, pursuant to Rule 102 of the Public Procurement Rules 2008; or

	(d) refuses to sign the Contract as stated under ITT Sub-Clause 70.2 pursuant to Rule 102 of the Public Procurement Rules 2008; or (e) does not accept the correction of the Tender price following the correction of arithmetic errors as stated under ITT Clause 55, pursuant to Rule 98(11) of the Public Procurement Rules 2008.
37. Format and Signing of Tender	37.1 Tenderers shall prepare one (1) original of the documents comprising the Technical Offer as described in ITT Clause 24.2 and clearly mark it “ORIGINAL OF TECHNICAL OFFER” In addition, the Tenderers shall prepare the number of copies of the Technical Offer, as specified in the TDS and clearly mark each of them “COPY OF THE TECHNICAL OFFER.” In the event of any discrepancy between the original and the copies, the ORIGINAL shall prevail.
	37.2 Tenderers shall prepare one (1) original of the documents comprising the Financial Offer as described in ITT Clause 24.3 and clearly mark it “ORIGINAL OF FINANCIAL OFFER” In addition, the Tenderers shall prepare the number of copies of the Financial Offer, as specified in the TDS and clearly mark each of them “COPY OF THE FINANCIAL OFFER” In the event of any discrepancy between the original and the copies, the ORIGINAL shall prevail.
	37.3 Alternatives, if permitted under ITT Clause 25, shall be clearly marked “Alternative”.
	37.4 The original and each copy of the Offer shall be typed or written in indelible ink and shall be signed by the Person duly authorized to sign on behalf of the Tenderer. This Tender specific authorization shall be attached to the Technical Offer Submission Letter (Form PW5A-1a) and Financial Offer Submission Letter (Form PW5A-1b). The name and position held by each Person(s) signing the authorization must be typed or printed below the signature. All pages of the original and of each copy of the Tender, except for un-amended printed literature, shall be numbered sequentially and signed by the person signing the Tender.
	37.5 Any interlineations, erasures, or overwriting will be valid only if they are signed or initialled by the Person (s) signing the Tender.
E. Tender Submission	
38. Sealing, Marking and Submission of Tender	38.1 Tenderers shall enclose the original of Technical Offer in one (1) envelope and all the copies of the Technical Offer, including the alternatives, if permitted under ITT Clause 25, in another envelope, duly marking the envelopes as “ORIGINAL OF TECHNICAL OFFER” “ALTERNATIVES” (if permitted), “COPY OF TECHNICAL OFFER,” “ALTERNATIVES” (if permitted) These sealed envelopes for the original and copies of the technical Tender shall then be enclosed and sealed in one single envelope and clearly mark it “Envelope-01: TECHNICAL OFFER”. 38.2 The inner and outer envelopes of Technical Offer shall:

	(a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 39.1; (b) bear the name of the Tender and the Tender Number as stated under ITT Sub Clause 1.1; (c) bear the name and address of the Tenderer; (d) bear a statement “DO NOT OPEN BEFORE -----” the time and date for Tender opening as stated under ITT Sub Clause 45.2 (e) bear any additional identification marks as specified in the TDS.
	38.3 Tenderers shall enclose the original of Financial Offer in one (1) envelope and all the copies of the Financial Offer in another envelope, duly marking the envelopes as “ORIGINAL OF FINANCIAL OFFER” & “COPY OF FINANCIAL OFFER”. These sealed envelopes for the original and copies of the Financial Tender shall then be enclosed and sealed in one single envelope and clearly mark it “ENVELOPE-02: FINANCIAL OFFER.”
	38.4 The inner and outer envelopes of Financial Offer shall: (a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 39.1; (b) bear the name of the Tender and the Tender Number as stated under ITT Sub Clause 1.1; (c) bear the name and address of the Tenderer; (d) bear a statement “DO NOT OPEN BEFORE THE TECHNICAL OFFER EVALUATION AND APPROVAL”. (e) bear any additional identification marks as specified in the TDS.
	38.5 The Envelope-01 as stated in ITT Clause 38.1 and Envelope-02 as in ITT Clause 38.3 shall then be enclosed and sealed in one single outer envelope which shall contain the information as stated under ITT Clause 38.2 (a) to (e) & ITT Clause 38.4 (a) to (e)
	38.6 Tenderers are solely and entirely responsible for pre-disclosure of Tender information if the envelope(s) are not properly sealed and marked.
	38.7 Tenders shall be delivered by hand or by mail, including courier services at the address(s) as stated under ITT Sub Clause 39.1.
	38.8 The Procuring Entity will, on request, provide the Tenderer with acknowledgement of receipt showing the date and time when it’s Tender was received.
39. Deadline for Submission of tenders	39.1 Tenders shall be delivered to the Purchaser at the address specified in the TDS and no later than the date and time specified in the TDS.

	39.2 The Purchaser may, at its discretion on justifiably acceptable grounds duly recorded, extend the deadline for submission of Tender as stated under ITT Sub Clause 39.1, in which case all rights and obligations of the Purchaser and Tenderers previously subject to the deadline will thereafter be subject to the new deadline as extended. 39.3 If submission of Tenders is allowed in more than one location, the date and time, for submission of Tenders for both the primary and the secondary place(s), shall be the “same and not different” as specified in the TDS. 39.4 The Procuring Entity shall ensure that the Tenders received at the secondary place(s) are hand-delivered at the primary place as stated under ITT Sub Clause 39.1, within THREE (3) HOURS after the deadline for submission of Tenders at the secondary place (s), in case of MULTIPLE DROPPING as stated under ITT Sub Clause 39.3, as specified in the TDS.
40. Late tender	37.6 Any Tender received by the Purchaser after the deadline for submission of Tenders as stated under ITT Clause 39, shall be declared LATE, rejected, returned unopened to the Tenderer.
41. Modification, Substitution or Withdrawal of Tenders	41.1 Tenderers may modify, substitute or withdraw its Tender after it has been submitted by sending a written notice duly signed by the authorized signatory and properly sealed, and shall include a copy of the authorization; provided that such written notice including the affidavit is received by the Procuring Entity prior to the deadline for submission of Tenders as stated under ITT Clause 39
42. Tender Modification	42.1 Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit corresponding modification either to its original Technical Offer or Financial Offer or both, marked as “MODIFICATION FOR TECHNICAL OFFER(MTO)” or “MODIFICATION FOR FINANCIAL OFFER (MFO)” with two separate envelopes. The envelope/envelopes marked as MTO and/or MFO then be enclosed and sealed in one single outer envelope with a written notice duly as stated under ITT Sub Clause 41.1. The outer envelope shall contain the information as stated under ITT Sub Clause 38.2(a) to (d) and clearly marked as “MODIFICATION (M)”.
43. Tender Substitution	43.1 Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit another Technical Offer or Financial Offer or both, marked as “SUBSTITUTION FOR TECHNICAL OFFER (STO)” or “SUBSTITUTION FOR FINANCIAL OFFER (SFO)” with two separate envelopes. The envelope/envelopes marked as STO and/or SFO then be enclosed and sealed in one single outer envelope with a written notice duly as stated under ITT Sub Clause 41.1. The outer envelope shall contain the information as stated under ITT Sub Clause 38.2(a) to (d) and clearly marked as “SUBSTITUTION (S)”.
44. Withdrawal of Tender	44.1 The Tenderer shall be allowed to withdraw its Tender by a Letter of Withdrawal marked as “WITHDRAWAL” prior to the deadline for submission of Tenders as stated under ITT Clause 39.

F. Tender Opening and Evaluation	
45. Tender Opening	45.1 Only the Technical Offer (Envelope-01) shall be opened immediately after the deadline for submission of Tenders at the primary place as specified in the TDS but not later than ONE HOUR, after expiry of the submission deadline at the same primary place unless otherwise stated under ITT Sub Clause 39.2. But with in THREE HOURS after the dateline of submission of tender at primary place in case of multiple dropping. Tender opening shall not be delayed on the plea of absences of Tenderers or his or her representatives. Financial offer (Envelope-02) shall not open with Technical offer (Envelope-01) and shall be kept unopened at the Custody of the Head of the Procuring Entity or his Authorised Officer (AO). 45.2 Persons not associated with the Tender may not be allowed to attend the public opening of Technical Offers. 45.3 Tenderers' representatives shall be duly authorised by the Tenderer. Tenderers or their authorised representatives will be allowed to attend and witness the opening of Technical Offers, and will sign a register evidencing their attendance. Technical Offers Opening shall not be delayed on the plea of absence of Tenderers or his or her representatives. 45.4 The authenticity of withdrawal or substitution of, or modifications to original Tender, if any made by a Tenderer in specified manner, shall be examined and verified by the Tender Opening Committee (TOC) based on documents submitted as stated under ITT Sub Clause 41.1. Any envelope related to financial modification, substitute shall be recorded but not open with technical offer. 45.5 Verify (M), (S), (W), (A), (O) by following step by steps (a) Step 1: envelopes marked "Withdrawal (W)" shall be opened and "Withdrawal" notice read aloud & recorded in the opening sheet. After verify the withdrawal letter is genuine, corresponding tender shall not be opened, but returned unopened to the Tenderer by Procuring Entity (PE) at a late time. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice shall be as stated in 41.1& 44.1 and in such case the Tender shall be opened and recorded. (b) Step 2: the remaining Tenders will be sorted out and those marked "SUBSTITUTION (S)" or "MODIFICATION (M)" of Tender will be linked with their corresponding Original Tender.

	(c) Step 3: outer envelopes marked “SUBSTITUTION (S)” shall be opened. The inner envelopes containing the “Substitution of Technical Offer (STO)” and/or “Substitution of Financial Offer (SFO)” shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Tenderer unopened by the Procuring Entity at a later time immediately after opening of Technical Offers. Only the Substitution of Technical Offer, if any, shall be opened, read out, and recorded. Substitution of Financial Offer will remain unopened in accordance with ITT Sub Clause 45.1. No envelope shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at Technical Offer opening. (d) Step 4: outer envelopes marked “MODIFICATION (M)” shall be opened. No Technical Offer and/or Financial Offer shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Offers. Only the Technical Offers, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Financial Offers, both Original as well as Modification, will remain unopened in accordance with ITT Sub Clause 45.1 (e) Step5: if so specified in this Tender Document, the envelopes marked “Alternative of Technical Offer (ATO)” shall be opened and read aloud with the corresponding Technical Offer and recorded. 45.6 Ensuring that only the correct (MTO), (STO), (ATO), (OTO) envelopes are opened, details of each Technical Offer will be dealt with as follows: (a) the Chairperson of the TOC will read aloud each Technical Offer and record in the Technical Offer Opening Sheet (TOOS): (i) the name and address of the Tenderer; (ii) state if it is a withdrawn, modified, substituted or original Technical Offer; (iii) any alternatives; (iv) record the rejection of the Tender which submitted Technical Offer and Financial Offer together in one envelope. (v) the presence or absence of any requisite Tender Security; and (vi) such other details as the Procuring Entity, at its discretion, may consider appropriate. (b) Only Technical Offer and alternatives read aloud at the Technical Offer Opening will be considered in evaluation.

	(c) all pages of the original version of the Technical Offer, except for un-amended printed literature, will be initialled by members of the TOC. Remember, No financial Offer shall be open with Technical Offer 45.7 Upon completion of Technical Offer opening, all members of the TOC and the Tenderers or Tenderer's duly authorised representatives attending the Technical Offer opening shall sign by name, address, designation, the TOS, copies of which shall be issued to the Head of the Procuring Entity or an officer authorised by him or her and also to the members of the TOC and any authorised Consultants and, to the Tenderers immediately. 45.8 The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record under ITT Sub Clause 45.7 45.9 No Tender i.e., Technical or Financial Offer shall be rejected at the Tender opening stage except the LATE Tenders as stated in the ITT Clause 40.
46. Evaluation of Tenders	46.1 Technical Offers shall be examined and evaluated only on the basis of the criteria specified in the Tender Document. 46.2 Tender Evaluation Committee (TEC) shall examine, evaluate and compare Tenders that are responsive to the requirements of Tender Documents in order to identify the successful Tenderer.
47. Evaluation Process	47.1 TEC may consider a Tender Offer as responsive in the Evaluation, only if it is submitted in compliance with the mandatory requirements set out in the Tender Document. The evaluation process should begin immediately after Technical Offer opening following Two steps: (a) Preliminary examination (b) Technical examination and responsiveness
48. Preliminary Examination	48.1 Compliance, adequacy and authenticity of the documentary evidences for meeting the qualification criterion specified in the corresponding section of the Tender document shall have to be preliminarily examined and verified. 48.2 The TEC shall firstly examine the Tenders to confirm that all documentation requested in ITT Clause 24 has been provided. Examination of the compliance, adequacy and authenticity of the documentary evidence may follow the order below: (a) verification of the completeness of the eligibility declaration in the Tender Submission Letter (Form PG5A-1), to determine the eligibility of the tenderer as stated under ITT Sub-Clause 24(h). Any alterations to its format, filling in all blank spaces with the information requested, failing which the tender may lead to rejection of the Tender; (b) verification of that the Tenderer is enrolled in the relevant professional or trade organisations as stated under ITT Clause 24(l);

	(c) verification of the eligibility in terms of legal capacity and fulfilment of taxation obligation by the tenderer in accordance as stated under ITT Sub-Clause 24(i) and 24(k); (d) verification of eligibility that the tenderer is not insolvent, in receivership, bankrupt, not in the process of bankruptcy, not temporarily barred as stated under ITT Sub-Clause 24(j); (e) verification of eligibility of Tenderer's country of origin as stated under ITT Sub-Clause 24(b); (f) verification of the written authorization confirming the signatory of the Tenderer to commit the Tender has been attached with Tender Submission Letter (Form PG5A-1) as stated under ITT Sub-Clause 24(g); in order to check the authenticity of Tender and Tenderer itself ; (g) verification of the Tender Security as stated under ITT Sub-Clause 24(d); and 48.3 The TEC shall confirm that the above documents and information have been provided in the Tender and the completeness of the documents and compliance of instructions given in corresponding ITT Clauses shall be verified, failing which the tender shall be considered rejection of that tender.
49. Technical Evaluation and Responsiveness	49.1 Only those Tenders surviving preliminary examination need to be examined in this phase. 49.2 Secondly, the TEC will examine the adequacy and authenticity of the documentary evidence which may follow the order below: (a) verification of the completeness of the country of origin declaration in the Price Schedule for Plant and Services (Form PG5A-3) as furnished in Section 5: Tender and Contract Forms to determine the eligibility of the Goods and Related Services as stated under ITT Sub Clause 24(m). (b) verification and examination of the documentary evidence and completed Technical Proposal (Form PG5A-4) as furnished in Section 5: Tender and Contract Forms to establish the conformity of the Goods and Related Services to the Tender Documents as stated under ITT Sub Clause 24(e) and 24(n). (c) verification and examination of the documentary evidence that the Tenderer's qualifications conform to the Tender Documents and the Tenderer meets each of the qualification criterion specified in Sub-Section C, Qualification Criteria as stated under ITT Sub Clause 24(o). (d) verification and examination of the documentary evidence that Tenderer has met all the requirements in regards under Section 6, Employer's Requirements, without any material deviation or reservation. (e) verification and examination of the documentary evidence and completed Specification Submission Sheet (Form

	PG5A-4a) to determine the conformity of the Goods and related services .
	49.3 TEC may consider a Tender as responsive in the evaluation, only if comply with the mandatory requirements as stated under Clause 49.2.
	49.4 The TEC's determination of a Tender's responsiveness is to be based on the documentary evidence as requested in Clause 49.2 without recourse to extrinsic evidence.
	49.5 Information contained in a Tender, that was not requested in the Tender Document shall not be considered in evaluation of the Tender.
	49.6 If a Tender is not responsive to the mandatory requirements set out in the Tender Document it shall be rejected by the TEC and shall not subsequently be made responsive by the Tenderer by correction of the material deviation, reservation.
	49.7 A material deviation or reservation is one- (a) which affects in any substantial way the scope, quality, or performance of the Goods and Related Services and Tenderer's qualifications mentioned in the Tender Document (b) which limits in any substantial way, inconsistent with the Tender Documents, the Purchaser's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would anyway affect unfairly the competitive position of other Tenderers presenting responsive Tenders.
	49.8 During the evaluation of Tender, the following definitions apply: (a) "Deviation" is a departure from the requirements specified in the Tender Document; (d) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Tender Document;
	49.9 A TEC may regard a Tender as responsive, even if it contains-minor or insignificant deviations, which do not meaningfully alter or depart from the technical specifications, characteristics and commercial terms and conditions or other requirements set out in the Tender Document; errors or oversights, which if corrected, would not alter the key aspects of the Tender.
50. Clarification on Technical Offer	50.1 TEC may ask Tenderers for clarification of their Technical Offers in order to facilitate the examination and evaluation of Technical Offers. The request for clarification by the TEC and the response from the Tenderer shall be in writing, and Technical Offers clarifications which may lead to a change in the substance of the Technical Offers or in any of the key elements of the Technical Offers as stated under ITT Sub Clause 49.2, will neither be sought nor be permitted. 50.2 Any request for clarifications by the TEC shall not be directed towards making an apparently non-responsive Tender

	responsive and reciprocally the response from the concerned Tenderer shall not be articulated towards any addition, alteration or modification to its Technical Offer. 50.3 If a Tenderer does not provide clarifications of its Technical Offer by the date and time, its Tender shall not be considered in the evaluation
51. Restrictions on Disclosure of Information	51.1 Following the opening of Technical Offers until issuance of Notification of Award no Tenderer shall, unless requested to provide clarification to its Tender or unless necessary for submission of a complaint, communicate with the concerned Procuring Entity 51.2 Tenderers shall not seek to influence in anyway, the examination and evaluation of the Tenders 51.3 Any effort by a Tenderer to influence the Procuring Entity in its decision concerning the evaluation of Tenders, Contract awards may result in the non-responsiveness of its Tender as well as further action in accordance with Section 64 (5) of the Public Procurement Act, 2006. 51.4 All clarification requests shall remind Tenderers of the need for confidentiality and that any breach of confidentiality on the part of the Tenderer may result in their Tender being non-responsive.
52. Approval of Technical Offer	52.1 TEC shall prepare the Technical Offer Evaluation Report and shall directly submit the Evaluation Report to the Head of the Procuring Entity (HOPE) or Authorized Officer for approval.
53. Financial Offer Opening	53.1 After receiving approval of the Technical Offer Evaluation Report, Financial Offer (Envelope-2) of only the Responsive Tenderers who have been determined as qualified to the requirements of the Technical Offer, shall be opened publicly, The Date, time and place of Financial Offer Opening shall be communicated to the Responsive Tenderers in writing by issuing a Financial Offer Opening notice not less than SEVEN DAYS before the opening.

	53.2 Ensuring that only the correct MFO, SFO, OFO envelopes of the Responsive Tenderers shall be opened, in the presence of the Responsive Tenderer's representatives who choose to attend, on the date, time and at the place as notified by the Procuring Entity in accordance with ITT Clause 53.1. Details of each Financial Offer will be dealt with as follows: (a) the Chairperson of the Tender Evaluation Committee will read aloud each Financial Offer and record in the Financial Offer Opening Sheet (FOOS): (i) the name and address of the Tenderer; (ii) state if it is a modified, substituted or original Financial Offer; (iii) the Tender Price; (iv) the number of initialled corrections; (v) any discounts; and (vi) any other details as the Procuring Entity, at its discretion, may consider appropriate (b) only the discounts and alternatives read aloud and recorded at the Financial Offer Opening will be considered in Financial Offer Evaluation. No Tenders shall be rejected at the opening of the Financial Offer. (c) all pages of the original version of the Financial Offer, except for un-amended printed literature, will be initialled by members of the Tender Evaluation Committee. (d) The Procuring Entity shall, in writing, notify the Non-responsive Tenderers who have not been determined as qualified to the requirements of the Technical Offer and shall return their Financial Offers (Envelope-02) unopened after signing of the contract.
54. Clarification on Financial Offer	54.1 TEC may ask Tenderers for clarification of their Financial Offers, about the breakdowns of unit rates, in order to facilitate the examination and evaluation of Financial Offers. The request for clarification by the TEC and the response from the Tenderer shall be in writing.
	54.2 Changes in the Tender price shall not be sought or permitted, except to confirm the correction of arithmetical errors discovered by the TEC in the evaluation of the Tenders, as stated under ITT Sub Clause 55.1.
	54.3 If a Tenderer does not provide clarifications of its Financial Offer by the date and time, its Tender shall not be considered in the evaluation.
	54.4 Requests for clarifications on Financial Offers shall be duly signed only by the TEC Chairperson.
55. Correction of Arithmetical Errors	55.1 The TEC shall correct any arithmetic errors that are discovered during the examination of Tenders, and shall promptly notify the

	concerned Tenderer(s) of any such correction(s) pursuant to Rule 98(11) of the Public Procurement Rule, 2008. 55.2 Provided that the Tender is responsive, TEC shall correct arithmetical errors on the following basis: (a) If there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the <u>unit price</u> shall prevail and the line item total shall be corrected, unless in the opinion of the TEC there is an obvious <u>misplacement of the decimal point</u> in the unit price, in which case the total price as quoted will govern and the unit price will be corrected; (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the <u>sub-totals</u> shall prevail and the total shall be corrected. 55.3 Any Tenderer that does not accept the correction of the Tender amount following correction of arithmetic errors as determined by the application of ITT Sub-Clause 55.2 shall be considered as non-responsive.
56. Conversion to Single Currency	56.1 For evaluation and comparison purpose, TEC shall convert all Tender prices expressed in the amounts in various currencies into an amount in Bangladeshi Taka currency, using the selling exchange rates established by the Bangladesh Bank, on the date of Tender opening.
57. Financial Evaluation	57.1 Thirdly the TEC, pursuant to Rule 98 of the Public Procurement Rules, 2008 shall evaluate each Tender that has been determined, up to this stage of the evaluation, to be responsive to the mandatory requirements in the Tender Document.. 57.2 To evaluate a Tender in this stage , the Purchaser shall consider the following (a) Verification and examination of the Price Schedule for Plant and Services (Form PG5-3) as furnished by the Tenderer and checking the compliance with the instructions provided under ITT Clause 26; (b) Evaluation will be done for Items or lot by lot as stated under ITT Clause 26 and the Total Tender Price as quoted in accordance with Clause 26; (c) Adjustment for correction of arithmetical errors as stated under ITT Sub-Clause 55.2; (d) Adjustment for price modification offered as stated under ITT Clause 41; (e) Adjustment due to discount as stated under ITT Sub-Clauses 26.11 and 57.3; (f) Adjustment due to the application of economic factors of evaluation as stated under ITT Sub-Clause 57.5 if any; (g) Adjustment due to the assessment of the price of unpriced items as stated under ITT Clause 58 if any; 57.3 If Tenders are invited for a single lot or for a number of lots as

	stated under ITT Sub-clauses 26.10, TEC shall evaluate only lots that have included at least the percentage of items per lot. The TEC shall evaluate and compare the Tenders taking into account: (a) Lowest evaluated tender for each lot ; (b) The price discount/reduction per lot; (c) Least cost combination for the Purchaser, considering discounts and the methodology for its application as stated under ITT Sub-clauses 26.10 and 26.11 offered by the Tenderer in its Tender. 57.4 Only those spare parts and tools which are specified as a item in the List of Goods and Related Services in Section 6, Employer's Requirement or adjustment as stated under ITT Sub-clause 54.5, shall be taken into account in the Tender evaluation. Supplier-recommended spare parts for a specified operating requirement as stated under ITT Sub-clause 28.2(b) shall not be considered in Tender evaluation. 57.5 The Purchaser's evaluation of a tender may require the consideration of other factors, in addition to the Tender Price quoted as stated under ITT Clause 26. The effect of the factors selected, if any, shall be expressed in monetary terms to facilitate comparison of tenders. The factors, methodologies and criteria to be used shall be as specified in TDS. The applicable economic factors, for the purposes of evaluation of Tenders shall be: (a) Adjustment for Deviations in the Delivery and Completion Schedule. (b) Cost of major replacement components, mandatory spare parts, and service. 57.6 Variations, deviations, and alternatives and other factors which are in excess of the requirements of the Tender Document or otherwise result in unsolicited benefits for the Purchaser will not be taken into account in Tender evaluation.
58. Price Comparison	58.1 The TEC shall compare all responsive Tenders to determine the lowest-evaluated Tender, as stated in ITT 57.2. 58.2 In the extremely unlikely event that there is a tie for the lowest evaluated price, the Tenderer with the superior past performance with the Purchaser shall be selected, whereby factors such as delivery period, quality of Goods delivered, complaints history and performance indicators could be taken into consideration. 58.3 In the event that there is a tie for the lowest price and none of the Tenderers has the record of past performance with the Purchaser, then the Tenderer shall be selected, subject to firm confirmation through the Post-qualification process described in ITT Clause 61, after consideration as to whether the quality of Goods that is considered more advantageous by the end-users.

	58.4 The successful Tenderer as stated under ITT Sub Clauses 58.1, 60.2 and 60.3 shall not be selected through lottery under any circumstances.
59. Post-qualification	59.1 After determining the lowest-evaluated responsive tender as sated under ITT Sub-Clause 58.1, the Purchaser's TEC pursuant to Rule 100 of the Public Procurement Rules, 2008, shall carry out the Post-Qualification of the Tenderer, using only the requirements specified in Sub-Section C, Qualification Criteria.
	59.2 The TEC shall contact the references given by Tenderers about their previous Supply experiences to verify, if necessary, statements made by them in their Tender and to obtain the most up-to-date information concerning the Tenderers.
	59.3 The TEC may visit the premises of the Tenderer as a part of the post-qualification process, if practical and appropriate, to verify information contained in its Tender.
	59.4 The TEC shall determine to its satisfaction whether the Tenderer that is selected as having submitted the lowest evaluated responsive Tender is qualified to perform the Contract satisfactorily.
	59.5 The objective of any visit under ITT Sub-Clause 59.3 shall be limited to a general and visual inspection of the Tenderer's facilities and its plant and equipment, and there shall be no discussion concerning the Tender or its evaluation with the Tenderer during such visit(s).
	59.6 In the event that the Tenderer with lowest evaluated cost fails the post-qualification, the TEC shall make a similar determination for the Tenderer offering the next lowest evaluated cost and so on from the remaining responsive Tenders, provided that, (a) such action shall only be taken if the evaluated costs of the Tenders under consideration are acceptable to the Purchaser; (b) when the point is reached whereby the evaluated costs of the remaining responsive Tenders are significantly higher than that of the official estimate, or the market price, the Purchaser may take action pursuant to Rule 33 of the PPR 2008 and may proceed for re-Tendering, using a revised Tender Document designed to achieve a more successful result.
60. Negotiation	60.1 No negotiations shall be held during the financial offer evaluation or award, with the lowest or any other Tenderer. 60.2 The Procuring Entity through the TEC may, however, negotiate with the lowest evaluated Tenderer with the objective to reduce the Contract Price by reducing the scope of works or a reallocation of risks and responsibilities, only when it is found that the lowest evaluated Tender is significantly higher than the official estimated cost; the reasons for such higher price being duly investigated. 60.3 If the Procuring Entity decides to negotiate for reducing the scope of the requirements under ITT Sub Clause 60.2, it will be required to guarantee that the lowest Tenderer remains the lowest Tenderer

	even after the scope of work has been revised and shall further be ensured that the objective of the Procurement will not be seriously affected through this reduction. 60.4 In the event that the Procuring Entity decides because of a high Tender price to reduce the scope of the requirements to meet the available budget, the Tenderer is not obliged to accept the award and shall not be penalised in any way for un-accepting the proposed award.
61. Rejection of All Tenders	61.1 The Purchaser may, in the circumstances as stated under ITT Sub-Clause 61.2 and pursuant to Rule 33 of the Public Procurement Rules 2008, reject all Tenders following recommendations from the Tender Evaluation Committee only after the approval of such recommendations by the Head of the Purchaser. rejected, if – 61.2 All Tenders can be rejected, if - (a) the price of the lowest evaluated Tender exceeds the official estimate, provided the estimate is realistic; or (b) there is evidence of lack of effective competition; such as non-participation by a number of potential Tenderers; or (c) the Tenderers are unable to propose completion of the delivery within the stipulated time in its offer, though the stipulated time is reasonable and realistic; or (d) all Tenders are non-responsive; or (e) evidence of professional misconduct, affecting seriously the Procurement process, is established pursuant to Rule 127 of the Public Procurement Rules, 2008. 61.3 Notwithstanding anything contained in ITT Sub-Clause 61.2 Tenders may not be rejected if the lowest evaluated price is in conformity with the market price. 61.4 A Purchaser may pursuant to Rule 35 of the Public Procurement Rules, 2008, on justifiable grounds, annul the Procurement proceedings prior to the deadline for the submission of Tenders. 61.5 All Tenders received by the Purchaser shall be returned unopened to the Tenderers in the event Procurement proceedings are annulled under ITT Sub-Clause 61.4.
62. Informing Reasons for Rejection	62.1 Notice of the rejection, pursuant to Rule 35 of the Public Procurement Rules, 2008, will be given promptly within <u>seven (7) days</u> of decision taken by the Purchaser to all Tenderers and, the Purchaser will, upon receipt of a written request, communicate to any Tenderer the reason(s) for its rejection but is not required to justify those reason(s).
G. Contract Award	
63. Award Criteria	63.1 The Purchaser shall award the Contract to the Tenderer whose offer is responsive to the Tender Document and that has been determined to be the lowest evaluated Tender, provided further that the Tenderer is determined to be Post-Qualified as stated under ITT Clause 59.

	63.2 A Tenderer shall not be required, as a condition for award of contract, to undertake obligations not stipulated in the Tender Document, to change its price, or otherwise to modify its Tender.
64. Notification of Award	64.1 Prior to the expiry of the Tender validity period and within seven (7) working days of receipt of the approval of the award by the Approving Authority, the Purchaser pursuant to Rule 102 of the Public procurement Rules, 2008, shall issue the Notification of Award (NOA) to the successful Tenderer.
	64.2 The Notification of Award, attaching the contract as per the sample (Form PG5A-7) to be signed, shall state: (a) the acceptance of the Tender by the Purchaser; (b) the price at which the contract is awarded; (c) the amount of the Performance Security and its format; (d) the date and time within which the Performance Security shall be submitted; and (e) the date and time within which the contract shall be signed.
	64.3 The Notification of Award shall be accepted in writing by the successful Tenderer within seven (7) working days from the date of issuance of NOA .
	64.4 Until a formal contract is signed, the Notification of Award shall constitute a Contract, which shall become binding upon the furnishing of a Performance Security and the signing of the Contract by both parties.
	64.5 The Notification of Award establishes a Contract between the Purchaser and the successful Tenderer and the existence of a Contract is confirmed through the signature of the Contract Document that includes all agreements between the Purchaser and the successful Tenderer.
65. Performance Security	65.1 The Performance Security shall be determined sufficient to protect the performance of the Contract pursuant to Rule 27 of the Public Procurement Rules, 2008.
	65.2 Performance Security shall be furnished by the successful Tenderer in the amount specified in the TDS and denominated in the currencies in which the Contract Price is payable pursuant to Rule 102 (8) of the Public Procurement Rules, 2008.
	65.3 The proceeds of the Performance Security shall be payable to the Purchaser unconditionally upon first written demand as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract.
66. Form and Time Limit for furnishing of Performance security	66.1 The Performance Security shall be in the form of irrevocable Bank Guarantee in the format (Form PG5A-9) as stated under ITT Clause 65, shall be issued by an internationally reputable bank and it shall have correspondent bank located in Bangladesh,

	to make it enforceable pursuant to Rule 27(4) of the Public Procurement Rules, 2008..
	66.2 Within twenty-eight (28) days from issue of the Notification of Award, the successful Tenderer shall furnish the Performance Security for the due performance of the Contract in the amount specified under ITT Sub Clause 65.2.
67. Validity of Performance Security	67.1 The Performance Security shall be required to be valid until a date twenty-eight (28) days beyond the date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations.
	67.2 If under any circumstances date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations is to be extended, the Performance Security shall correspondingly be extended for the extended period.
68. Authenticity of performance Security	69.1 The Purchaser shall verify the authenticity of the Performance Security submitted by the successful Tenderer by sending a written request to the branch of the bank issuing irrevocable Bank Guarantee in specified format.
	69.2 If the Performance Security submitted under ITT Sub Clause 65.2 is not found to be authentic, the Purchaser shall proceed to take measures against the Tenderer in accordance with Section 64 of the Act and pursuant to Rule 127 of the Public Procurement Rules, 2008.
69. Contract Signing	69.1 At the same time as the Purchaser issues the Notification of Award, the Purchaser shall send the draft Contract Agreement and all documents forming the Contract pursuant to Rule 102 of the Public Procurement Rule, 2008, to the successful Tenderer. 69.2 Within twenty-eight (28) days of the issuance of Notification of Award, the successful Tenderer and the Purchaser shall sign the contract provided that the Performance Security submitted by the Tenderer is found to be genuine. 69.3 If the successful Tenderer fails to provide the required Performance Security, as stated under ITT Clause 65 or to sign the Contract , as stated under ITT Sub-Clause 69.2, Purchaser shall proceed to award the Contract to the next lowest evaluated Tenderer, and so on, by order of ranking pursuant to Rule 102 of the Public Procurement Rules,2008.
70. Publication of Notification of Award of Contract	70.1 Notification of Awards for Contracts of Taka 10 (ten) million and above shall be notified by the Purchaser to the Central Procurement Technical Unit within 7(seven) days of issuance of the NOA for publication in their website, and that notice shall be kept posted for not less than a month pursuant to Rule 37 of the Public Procurement Rules, 2008.

	70.2 Notification of Award for Contracts below Taka 10(ten) million, shall be published by the Purchaser on its Notice Board and where applicable on the website of the Purchaser and that notice shall be kept posted for not less than a month pursuant to Rule 37 of the Public Procurement Rules, 2008..
71. Debriefing of Tenderers	72.1 Debriefing of Tenderers by Purchaser shall outline the relative status and weakness only of his or her Tender requesting to be informed of the grounds for not accepting the Tender submitted by him or her pursuant to Rule 37 of the Public Procurement Rule, 2008, without disclosing information about any other Tenderer.
	72.2 In the case of debriefing confidentiality of the evaluation process shall be maintained.
72. Right to Complain	72.1 Any Tenderer has the right to complain if it has suffered or likely to suffer loss or damage due to a failure of a duty imposed on the Purchaser to fulfil its obligations in accordance with Section 29 of the Public Procurement Act 2006 and pursuant to Part 12 of Chapter Three of the Public Procurement Rules, 2008.
	72.2 Circumstances in which a formal complaint may be lodged in sequence by a potential Tenderer against a Purchaser pursuant to Rule 56 of the Public Procurement Rules, 2008, and the complaints, if any, be also processed pursuant to Rule 57 of the Public Procurement Rules 2008.
	72.3 The potential Tenderer shall submit his or her complaint in writing within seven (7) calendar days of becoming aware of the circumstances giving rise to the complaint.
	72.4 In the first instance, the potential Tenderer shall submit his or her complaint to the Purchaser who issued the Tender Document.
	72.5 The place and address for the first stage in the submission of complaints to the Administrative Authority is provided in the TDS .
	72.6 The Tenderer may appeal to a Review Panel only if the Tenderer has exhausted all his or her options of complaints to the administrative authority as stated under ITT Sub-Clause 72.2.

Section 2. Tender Data Sheet

Instructions for completing the Tender Data Sheet are provided, as needed, in the notes in italics and under lined mentioned for the relevant ITT clauses.

ITT Clause	Amendments of, and Supplements to, Clauses in the Instruction to Tenderers
A. General	
ITT 1.1	The Purchaser is Northern Electricity Supply Company PLC Representative: Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752. e-mail: se.procurement@nesco.gov.bd The Name and identification number of Tender is: Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with 4D(5mX5m) Bay extension at Sherpur Grid, Bogura on Turnkey Basis Invitation Ref No: 27.29.0000.012.07.064.25- 501; Date: 26/06/2025
ITT 1.2	The number, identification and name of lots comprising the Tender are: Single Lot on Turnkey Basis
ITT3.1	The source of public funds is: Own fund of NESCO
ITT3.3	The name of the Development Partner is: None
ITT5.1	Tenderers from the following countries are not eligible: Israel
ITT 5.13	Tenderers shall have the following up to date valid License 1. ABC Category Electrical Supervisory License from Bangladesh Electrical Licensing Board for Bangladeshi tenderers, similar/equivalent license from native country for foreign tenderers. 2. Trade/Business License. 3. Import License.
ITT6.1	Materials, Equipment and associated services from the following countries are not eligible: Israel
B. Tender Document	
ITT8.2	The following are the offices of the Purchaser or authorised agents for the purpose of providing the Tender Document: Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, 3rd Floor, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd





ITT9.1	For <u>clarification of Tender Document purposes</u> only, the Procuring Entity's address is: Attention: Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, 3rd Floor, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd
ITT10.1	A Pre-Tender meeting shall not be held
C. Qualification Criteria	
ITT 13.1	The maximum Three (3) number of arbitrations against the Tenderer over a period of last five (5) Years.
ITT14.1 (a)	The Tenderer shall have a minimum of Five (05) years of overall experience in the role of contractor, subcontractor, or management contractor.
ITT 14.1(b)	The minimum specific experience as a Contractor or Subcontractor or Management Contractor in similar to the proposed plant and services in at least a number of One contract of similar nature, complexity and methods/construction technology successfully completed within the last 7 (Seven) years, with a value of at least Tk. 2.75 (Two Point Seven Five) Crore. <u>Note:</u> 1. <i>The Tenderer shall have to submit End User Certificate(s) in End User's official pad; in favor of above-mentioned experience stating that the performance of the supplied plant and services are satisfactory for at least one (01) year.</i> 2. <i>The End User Certificate(s) duly signed by the end user shall mention the name & commissioning date of the plant and services which were designed, supplied, installed/constructed, tested and commissioned by Tenderer (lead partner in case of JV) and shall contain end-user's full mailing address, e-mail address, website address, fax number and phone number for the convenience of authentication. In any case, NESCO reserve the right to verify authenticity of End User Certificate(s).</i> 3. <i>Certificate(s) those are not in Bangla/English must be notarized on translated English version.</i>
ITT 15.1(a)	The required average annual turnover shall be greater than 06 (Six) Crore within the last 3 (<i>Three</i>) years.
ITT 15.1(b)	The minimum amount of liquid assets or working capital or credit facilities of the Tenderer shall be BDT 4.50 (Four Point Five Zero) Crore. Must be Supported by Credit Line (without any alternation/edit of Form PG5A-6a in Section:5 from any Scheduled Bank of Bangladesh (Except Community Bank and NCC Bank); otherwise the tender shall be non-responsive.

ITT 16.1(a)	A Project Manager, Engineer, and other key staff shall have the following qualifications and experience:				
	No	Position	Qualification	Total Works Experience (Years)	Experience in similar works (Years)
	01	Project Manager	Minimum B.Sc. in EEE/ME/CE	05	02
	02	Electrical Engineer	Minimum B.Sc. in EEE	02	01
	03	Protection/ Control Engineer	Minimum B.Sc. in EEE	02	01
	04	Civil Engineer	Minimum B.Sc. in CE	03	01
	05	Site supervisor	Minimum Diploma in Electrical	04	02
	The tenderer shall provide detailed CV of proposed personnel in Tenderer’s letterhead pad. The CVs must be endorsed by the tenderer..				
ITT 17.1	The Tenderer shall own or have proven access to hire or lease of the major equipment, in full working order as follows :				
	No	Equipment Type and Characteristics		Minimum Number Required	
	01	Transportation Vehicles		As required	
	02	Relay test set		01 set	
	03	Primary Current Injector		01 set	
	04	Secondary Current Injector		01 set	
	05	Earth tester		01 set	
	06	Insulation testers (5 kV)		01 set	
	07	Live-Line Voltage & Current Measuring Tools		01 set	
	08	Others		As required	
ITT 18.1	The value of non-judicial stamp for execution of the Joint Venture Agreement shall be Tk 300 only.				
	Maximum number of partners in the JV shall be “not limited”				

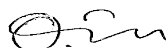
ITT 18.2	The minimum qualification requirements of Leading Partner, other Partner(s) and requirements by summation of a JV shall be as follows:			
	TDS Clauses References	Requirements by summation	Requirements for Leading Partner	Requirements for other Partner(s)
	ITT-14.1(a)	Summation not applicable	Same as stated in TDS	Same as for Leading Partner
	ITT-14.1(b)	100%	At least one Contract	Not applicable
	ITT-15.1(a)	100%	40%	25%
	ITT-15.1(b)	100%	40%	25%
	ITT-16.1(a)	100%	Not applicable	Not applicable
	ITT-17.1	100%	Not applicable	Not applicable
D. Tender Preparation				
ITT 19.2	<i>The maximum of percentage 20% of Goods allowed to be subcontracted</i>			
ITT 19.4	The Nominated Subcontractor(s) named [<i>insert name(s)</i>] shall execute the following specific components of the proposed Works: None			
ITT 20.1	Tenders are being invited for <i>single lot</i>			
ITT 24.2(r)	The Tenderer shall submit with its technical offer the following additional documents: 1. Sealed & signed original Tender Document (which was issued by NESCO) by a person duly authorized to sign on behalf of the tender. Copy of issued tender document will not be acceptable. 2. Registration /Certificate of Incorporation /Trade licence in its country of origin / relevant documents as documentary evidence to satisfy experience criteria as stated in ITT 14.1(a). 3. End User certificate as documentary evidence to satisfy experience criteria as stated in ITT 14.1(b). 4. Audited Financial Reports or Cash flow statements. 5. Personnel Information form shall be endorsed by the Tenderer on his official pad as documentary evidence to satisfy the criteria as stated in ITT 16.1(a) 6. Equipment Information form shall be endorsed by Tenderer on his official pad as documentary evidence to satisfy the criteria as stated in ITT 17.1. 7. Warranty Certificate (Form PG5A-12) from Tenderer as per GCC 42. 8. Guaranteed Technical Particulars (GTP) in Section 8 shall be properly filled up in manufacturer's official pad with submission of related supporting documents & signed by the Manufacturer & Tenderer. 9. At least 01 (one) nos. Manufacturer's Satisfactory Performance Certificates from Electricity Utility as End User depicting that each offered type or higher capacity rating 33kV Outdoor VCB, 33kV PCM Panel, 33kV LA, CT & PT of same voltage class within last 10 (ten) years i.e. years counting backward from the date of publication of IFT in the newspaper and has been in satisfactorily service for at least 01(one) year. The Satisfactory			

	Performance Certificate (SPC) shall be in End User's official pad and shall contain end-user's full mailing address, e-mail address, website address and fax / telephone number for the convenience of authentication. Note: Electricity Utility means an organization/company that engages in electricity generation/transmission/distribution of electricity. <u>For 33KV VCB with PCM Panel:</u> 10. Manufacturer's authorization for Protective Relays from ABB (Switzerland/Sweden/Finland) or Siemens (Germany) or Schneider Electric (UK/France) or ALSTOM (UK/France), SEL, USA & Energy Meters from Siemens (Germany/Switzerland) or AEG (Germany) or Itron (USA) or Elster (USA/Romania) or Landis+ Gyr (Switzerland/Greece) or Toshiba (Japan) or Honeywell (USA) or CEWE (UK) in prescribed Form (PG5A-5). <u>11. Type Test Certificates & Reports:</u> <u>For 33KV Switchgear (Outdoor VCB with PCM):</u> Type Test Certificates & Reports for offered type similar or higher Ampere rating Outdoor Vacuum Circuit Breaker for same voltage class from any short-circuit testing liaison (STL) Member [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory as per relevant IEC standard. The type test report along with results shall include at least the following tests: - Lightning Impulse Voltage withstand tests - Power Frequency withstand tests - Temperature Rise tests - Measurement of Resistance of the main circuit. - Short-time withstand current and peak withstand current tests. - Mechanical Endurance tests - Short Circuit performance tests - Out-of-phase making & breaking tests - IP55 tests. 12. All Protective Relays Test Certificate according to IEC 61850. <u>For 33kV CT & PT.</u> 13. Type Test Certificates & Reports for offered type similar or higher ampere rating CT & PT from any independent testing laboratory as per relevant IEC standard. 14. The Tenderer shall mention maximum days required to complete the supply of equipment/ materials (at site) and maximum days required for the completion of actual design, erection, installation, testing, commissioning & Civil work in bar chart form within the completion time. 15. All Tender Forms as thereof. 16. Site visit Report. 17. Drawing (SLD, Layout Drawing etc.)
24.3(c)	The Tenderer shall submit with its financial offer the following additional documents: None

ITT 25.1	Alternatives <i>shall not be</i> permitted.
ITT 26.1	Tenderers shall quote for the entire Plant and Installation Services on a single responsibility basis.
26.5(a)	<i>Place of Destination:</i> Sherpur 132/33 kV Grid Substation, Bogura <i>or Store of NESCO.</i>
26.5(d)	local transportation to named place of final destination is: Sherpur 132/33 kV Grid Substation, Bogura <i>or Store of NESCO.</i>
ITT 26.7	The prices quoted by the Tenderer shall be fixed for the duration of the Contract.
ITT 27.4	Name of the foreign currency: <i>None</i>
ITT 28.1 (b)	Spare parts are: required as per Section: 5, 6, 7 Period of time the Equipment are expected to be functioning (for the purpose of spare parts): 20 (Twenty) years from issuing of FAC <i>[Note: <u>Such spare parts as the Purchaser may elect to purchase from the supplier, provided that this election shall not relieve the supplier of any warranty obligations under the contract; Such spare parts that the Purchaser may be able to purchase from other supplier/manufacturers but are compatible with the goods procured</u>]</i>
ITT 30.2	The Tender validity period shall be 120 days.
ITT 32.2	The amount of the Tender Security shall be <i>BDT 8,00,000.00 (Eight Lakh) in favour of "Procuring Entity (PE), NESCO, Rajshahi."</i>
ITT 37.1	In addition to the original of the Tender followings shall be submitted within the date and time mentioned in the Tender Notice: 1. 1 (One) hard copy of the Tender. 2. 1 (One) electronic copy (Searchable PDF) of the technical offer in USB memory. In case of discrepancies, the information provided in the "Original" hard copy of the tender shall prevail.
E. Submission of Tender	
ITT 38.2(e)	The inner and outer envelopes shall bear the following additional identification marks: 1. Date of Submission 2. Seal & Signature of the Tenderer Book Binding and Page Number is required for original and copies. Any Technical offer associated with Financial offer in the same envelopes will be rejected.
ITT 38.4(e)	The inner and outer envelopes shall bear the following additional identification marks: 1. Date of Submission. 2. Seal & Signature of the Tenderer.
ITT 39.1	For <u>Tender submission purposes</u> , the Purchaser's address is: Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: <u>se.procurement@nesco.gov.bd</u>

	The deadline for submission of Tenders is: as specified in tender notice or amendment of submission time (if any). Electronic Tender submission is not permitted.
ITT 39.3	For <u>Tender submission purposes</u> only, the Procuring Entity's address is: Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd Electronic Tender submission is not permitted. Address (SECONDARY PLACES): Not Applicable. The deadline for submission of Tenders is: as specified in tender notice or amendment of submission time (if any).
ITT 39.4	The deadline for hand-delivering of the Tenders at the PRIMARY PLACE is: as specified in tender notice or amendment of submission time (if any)
F. Opening and Evaluation of Tenders	
ITT 45.1	The technical offer opening shall take place at: Superintending Engineer (Procurement), NESCO Ltd., Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd Time & Date: as specified in Tender notice or amendment of submission time (if any).
ITT 57.5	The applicable economic factors, for the purposes of evaluation of Tenders shall be: (a) <u>Adjustment for Deviations in the Delivery and Completion Schedule</u> <i>"The Plant and Service covered by this Tendering process are required to be delivered in accordance with, and completed within, the Delivery and Completion Schedule specified in Section 6, Employer's Requirements. No credit will be given for earlier completion. Tender offering late contract performance schedules within acceptable period will be accepted but the tenders shall be Adjusted in the evaluation by adding to the Tender Price at the rate of [specify percentage] of the Tender Price for each day of delay. Tender offering delivery schedules beyond [specify time Limit] of the date specified in Section 6, Employer's Requirement, shall be rejected." – Not Applicable.</i> (b) <u>Cost of major replacement components, mandatory spare parts, and service</u> <i>The Procuring Entity will draw up a list of high-usage and high-value items of components and spare parts [specify (spare parts, tools, major assemblies, estimated quantities)] of usage in the initial period [specify period] of operation. The total cost of these items and quantities will be computed from spare parts unit prices submitted by the Tenderer and added to the tender price, for evaluation purposes only. – Not Applicable.</i> (c) <u>Other factors affecting the true economic value</u> <i>The Procuring Entity will draw up other factors affecting the true economic value of the Tender price may be life span costs, such as cost of fuel, performance or productivity of the</i>

	<i>equipment, etc. The total cost of these items and quantities will be computed from submitted Tender and added to the tender price, for evaluation purposes only. – Not Applicable</i>
G. Award of Contract	
ITT 65.2	The amount of Performance Security shall be 10% (ten percent) of the Contract Price.
ITT 72.5	The name and address of the office where complaints to the Purchaser are to be submitted is: Superintending Engineer (Procurement), NESCO , Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd


Section 3. General Conditions of Contract

A. General

1. Definitions

- 1.1 In the Conditions of Contract, which include Particular Conditions and these General Conditions, the following words and expressions shall have the meaning hereby assigned to them. Boldface type is used to identify the defined terms:
- (a) **Approving Authority** means the authority which, in accordance with the Delegation of Financial powers, approves the award of Contract for the Procurement of Goods, Works and Services.
 - (b) **Act means** The Public Procurement Act, 2006 (Act 24 of 2006).
 - (c) **Commissioning** means operation of the Facilities or any part thereof by the Contractor following Completion, which operation is to be carried out by the Contractor for the purpose of carrying out Guarantee Test(s).
 - (d) **Competent Authority** means the authority that gives decision on specific issues as per delegation of administrative and/or financial powers.
 - (e) **Completion** means that the Facilities (or a specific part thereof where specific parts are specified in the Contract) have been completed operationally and structurally and put in a tight and clean condition, that all work in respect of Pre Commissioning of the Facilities or such specific part thereof has been completed, and that the Facilities or specific part thereof are ready for Commissioning.
 - (f) **Completion Certificate** means the Certificate issued by the Project Manager as evidence that the Contractor has executed the services in all respects as per design, drawing, specifications and Conditions of Contract.
 - (g) **Completion Date** is the actual date of completion of the plant and services certified by the Project Manager, in accordance with GCC Clause 24.
 - (h) **Contract Agreement** means the Agreement entered into between the Procuring Entity and the Contractor, together with the Contract Documents referred to therein, including all attachments, appendices, and all documents incorporated by reference therein to supply and install Plant & Equipment
 - (i) **Contract Documents** means the documents listed in GCC Clause 6, including any amendments thereto.
 - (j) **Contractor/supplier** means the Person under contract with the Procuring Entity for the supply and installation of Plant & Equipment under the Rules and the Act as stated in the **PCC**.
 - (k) **Contractor's Representative** means any person nominated by the Contractor and approved by the Employer to perform the duties delegated by the Contractor.

	(l) Contract Price means the price payable to the Contractor as specified in the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, for the supply and installation of plant & equipment in accordance with the provisions of the Contract, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract. (m) Cost means all expenditures reasonably incurred or to be incurred by the Contractor, whether on or off the Site, including overhead ,profit, taxes, duties, fees, and such other similar levies (n) Day means calendar day unless otherwise specified as working days. (o) Dayworks means work carried out following the instructions of the Procuring Entity or the authorised Project Manager and is paid for on the basis of time spent by the Contractor's workers and equipment at the rates specified in the Schedules, in addition to payments for associated Materials and Plant. (p) Defect is any part of the Works not completed in accordance with the Contract. (q) Defect Liability Period means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in contract document. (r) Defects Correction Certificate is the certificate issued by the Project Manager upon correction of defects by the Contractor. (s) Drawings include calculations and other information provided in Section 7 or as approved by the Project Manager for the execution and completion of the Contract. (t) Effective Date means the date of fulfillment of all conditions of the Contract Agreement, from which the Time for Completion shall be counted. (u) Equipment means all facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Facilities. (v) Facilities means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract. It also includes any ancillary building or infra structure that needs to be constructed/built/erected to support the plant. (w) Force Majeure means an event or situation beyond the control of the Contractor that is not foreseeable, is unavoidable, and its origins not due to negligence or lack of care on the part of the Contractor; such events may include, but not be limited to, acts of the Government in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes or more as included in GCC Clause 52. (x) Goods mean the Contractor's Plant, Equipment, Materials or any of them as appropriate.

	(y) GCC means the General Conditions of Contract. (z) Government means the Government of the People's Republic of Bangladesh. (aa) Guarantee Test(s) means the test(s) specified in the Employer's Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, in accordance with the provisions of GCC Sub-Clause 25.2 (Guarantee Test) hereof. (bb) Head of the Procuring Entity means the Secretary of a Ministry or a Division, the Head of a Government Department or Directorate; or the Chief Executive, by whatever designation called, of a local Government agency, an autonomous or semi-autonomous body or a corporation, or a corporate body established under the Companies Act; (cc) Installation Services means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc. as the case may require. (dd) Intended Completion Date is the date calculated from the Commencement Date as specified in the 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. (ee) Materials means things of all kinds other than Plant intended to form or forming part of the Permanent Works, including the supply-only materials, if any, to be supplied by the Contractor under the Contract. (ff) Month means calendar month. (gg) Original Contract Price is the Contract Price stated in the Procuring Entity's Notification of Award (Form PG5A-7) and further clearly determined in the PCC. (hh) Operational Acceptance means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor's fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of contract (ii) PCC means the Particular Conditions of Contract. (jj) Plant means permanent plant, equipment, machinery, apparatus, materials, articles, ancillary buildings/structure and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be

	supplied by the Contractor), but does not include Contractor's Equipment. (kk) Pre Commissioning means the testing, checking and other requirements specified in the Employer's Requirements that are to be carried out by the Contractor in preparation for Commissioning. (ll) Procuring Entity/Employer/Purchaser means, as the context so applies, an Entity having administrative and financial powers to undertake procurement of Plant and Physical services using public funds and is as named in the PCC who employs the Contractor to carry out the contractual obligations. (mm) Project Manager is the person named in the PCC or any other competent person appointed by the Procuring Entity and notified to the Contractor who is responsible for supervising the execution and completion of the plant and services and administering the Contract. (nn) Schedules means the document(s) entitled schedules, completed by the Contractor and submitted with the Tender Submission Letter, as included in the Contract. Such document may include the data, lists and schedules of rates and/or prices. (oo) Site means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the PCC as forming part of the Site (pp) Site Investigation Reports are those that were included in the Tender Document and are factual and interpretative reports about the surface and subsurface conditions at the Site. (qq) Specification means the Specification of the goods/works/related services included in the Contract and any modifications or additions to the specifications made or approved by the Project Manager in accordance with the Contract. (rr) Start Date is the date defined in the PCC and it is the last date when the Contractor shall commence execution of the goods/works/services under the Contract. (ss) Subcontractor means a person or corporate body, who has a contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site. (tt) Time for Completion means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, in accordance with the relevant provisions of the Contract. (uu) Variation means any change to the plant and services directly procured from the original Contractor to cover increases or decreases in quantities, including the introduction of new work items that are either due to change of plans, design or alignment to suit actual field conditions, within the general scope and physical boundaries of the contract. (vv) Works means all works associated with the construction, reconstruction, site preparation, demolition, repair, maintenance or renovation of railways, roads, highways, or a building, an infrastructure or structure or an installation or any construction work

	relating to excavation, installation of equipment and materials, decoration, as well as physical services ancillary to works as detailed in the PCC, if the value of those services does not exceed that of the Works themselves. (ww) Writing means communication written by hand or machine duly signed and includes properly authenticated messages by facsimile or electronic mail.
2. Interpretation	2.1 In interpreting the GCC, singular also means plural, male also means female or neuter, and the other way around. Headings in the GCC shall not be deemed part thereof or be taken into consideration in the interpretation or construance of the Contract. Words have their normal meaning under the language of the Contract unless specifically defined.
	2.2 Entire Agreement. The Contract constitutes the entire agreement between the Employer and the Contractor and supersedes all communications, negotiations and agreements (whether written or verbal) of parties with respect thereto made prior to the date of Contract Agreement; except those stated under GCC Sub Clause 6.1(j).
	2.3 Non waiver. (b) Subject to GCC Sub Clause 2.3(b), no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.
	(b) Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, dated, and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.
	2.4. Severability If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.
	2.5. Sectional completion If sectional completion is specified in the PCC, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).
3. Communications & Notices	3.1 Communications between Parties such as notice, request or consent required or permitted to be given or made by one party to the other pursuant to the Contract shall be in writing to the addresses specified in the PCC.

	3.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later. 3.3 A Party may change its address for notice hereunder by giving the other Party notice of such change to the address.
4. Governing Law	4.1 The Contract shall be governed by and interpreted in accordance with the laws of the People's Republic of Bangladesh.
5. Governing Language	5.1 The Contract shall be written in English. All correspondences and documents relating to the Contract may be written in English. Supporting documents and printed literature that are part of the Contract may be in another language, provided they are accompanied by an accurate translation of the relevant passages in English, in which case, for purposes of interpretation of the Contract, such translation shall govern. 5.2 The Contractor shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.
6. Documents Forming the Contract and Priority of Documents	6.1 The following documents forming the Contract shall be interpreted in the following order of priority: (a) the signed Contract Agreement (Form PG5A-8); (b) the Notification of Award (PG5A-7); (c) the completed Tender and the Appendix to the Tender; (d) the Price Schedule for Plant and Services (PG5A-3); (e) the Particular Conditions of Contract; (f) the General Conditions of Contract; (g) the Technical Specifications; (h) Personnel Information; (i) Equipment Information; (j) the Drawings; and (k) Any other document listed in the PCC forming part of the Contract.
7. Contract Agreement	7.1 The parties shall enter into a Contract Agreement within twenty eight (28) days from the date of issuance of the Notification of Award (NOA). The costs of stamp duties and similar charges, if any, designated by the applicable law in connection with entry into the Contract Agreement, shall be borne by the Employer.
8. Assignment	8.1 Neither the Contractor nor the Employer shall assign, in whole or in part, its obligations under the Contract; except with the Employer's prior written approval.
9. Eligibility	9.1 The Contractor and its Subcontractor(s) shall have the nationality of a country other than that specified in the PCC. 9.2 All materials, equipment, plant, and supplies used by the Contractor in both permanent and temporary works and services supplied under the Contract shall have their origin in the countries except any specified in the PCC.

10. Gratuities / Agency fees	10.1 No fees, gratuities, rebates, gifts, commissions or other payments, other than those included in the Contract, shall be given or received in connection with the procurement process or in the Contract execution.
11. Confidential Details	11.1 The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data, or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following completion or termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor such documents, data, and other information it receives from the Employer to the extent required for the Subcontractor to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor an undertaking of confidentiality similar to that imposed on the Contractor under GCC Clause 11.
	11.2 The Employer shall not use such documents, data, and other information received from the Contractor for any purposes unrelated to the Contract. Similarly, the Contractor shall not use such documents, data, and other information received from the Employer for any purpose other than the design, construction, or other work and services required for the performance of the Contract.
	11.3 The obligations of a party under GCC Sub Clauses 11.1 and 11.2 above, however, shall not apply to information that: the Employer or Contractor needs to share with institutions participating in the financing of the Contract; now or hereafter enters the public domain through no fault of that party; can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party; or otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality.
	11.4 The above provisions of GCC Clause 11 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Works or any part thereof.
	11.5 The provisions of GCC Clause 11 shall survive completion or termination, for whatever reason.
12. Joint Venture (JV)	12.1 If the Contractor is a Joint Venture, Consortium, or Association (JVCA), (a) each partner of the JV shall be jointly and severally liable for all liabilities and ethical or legal obligations to the Employer for the performance of the Contract; (b) the JV partners shall nominate a representative who shall have the authority to conduct all business including the receipt of payments for and on behalf of all partners of the JV; (c) in the event of a dispute that results in legal action against all partners of the JV, if they are available and if only one partner is available, then that partner alone shall answer on behalf of all partners and, if

	the complaint lodged is proven, the penalty shall be applicable on that lone partner as whatever penalty all the partners would have received. (d) the JV shall notify the Employer of its composition and legal status which shall not be altered without the prior approval of the Employer. (e) alteration of partners shall only be allowed if any of the partners is found to be incompetent or has any serious difficulties which may impact the overall implementation of the goods/works/service, whereby the incoming partner shall require to possess qualifications equal to or higher than that of the outgoing partner. (f) if any of the partners of JV has been debarred from participating in any procurement activity due to corrupt, fraudulent, collusive or coercive practices, that JV partner shall be altered following provisions under GCC Sub Clause 12.1 (d) and (e), while in case the Leading Partner has been debarred due to the same reasons stated herein the Contract shall be terminated as stated under GCC Sub Clause 67.1(b).
13. Possession of the Site	13.1 The Employer shall give possession of the Site or part(s) of the Site, to the Contractor on the date(s) stated in the PCC. If possession of a part of the Site is not given by the date stated in the PCC, the Employer will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event.
14. Access to the Site	14.1 The Contractor shall allow the Engineer and any person authorised by the Engineer access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.
15. Safety, Security and Protection of the Environment	15.1 The Contractor shall throughout the execution and completion of the Works and the remedying of any defects therein: (a) take all reasonable steps to safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state; (b) provide and maintain at the Contractor's own cost all lights, guards, fencing, warning signs and watching for the protection of the Works or for the safety on-site; and (c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.
16. Working Hours	16.1 The Contractor shall not perform any work on the Site on the weekly holidays, or during the night or outside the normal working hours, or on any religious or public holiday, without the prior written approval of the Project Manager.
17. Welfare of Laborers	17.1 The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's personnel relating to their employment, health, safety, welfare, immigration and shall allow them all their legal rights. 17.2 The Contractor, in particular, shall provide proper accommodation to his or her labourers and arrange proper water supply, conservancy and sanitation arrangements at the site for all necessary hygienic requirements and for the prevention of epidemics in accordance with relevant regulations, rules and orders of the government.

	17.3 The Contractor, further in particular, shall pay reasonable wages to his or her labourers, and pay them in time. In the event of delay in payment the Employer may effect payments to the labourers and recover the cost from the Contractor.
	17.4 The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take appropriate protective measures to prevent accidents that could result in injury. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.
18. Child Labor	18.1 The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development in compliance with the applicable laws and other relevant treaties ratified by the government.
19. Fossils& antiquities	19.1 All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.
	19.2 The Contractor shall, upon discovery of any such finding, promptly give notice to the Project Manager, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs cost from complying with the instructions, the Contractor shall give a further notice to the Project Manager and shall be entitled subject to Claims under GCC Clause 71
20. Corrupt, Fraudulent, Collusive or Coercive Practices	20.1 The Government requires that Employer, as well as the Contractor shall observe the highest standard of ethics during the implementation of procurement proceedings and the execution of the Contract.
	20.2 The Government requires that Employer, as well as the Contractor shall, during the Procurement proceedings and the execution of the Contract under public funds, ensure- (a) strict compliance with the provisions of Section 64 of the Public Procurement Act, 2006 (b) abiding by the code of ethics as mentioned in the Rule 127 of the Public Procurement Rules, 2008; (c) that neither it, nor any other member of its staff, or any other agents or intermediaries working on its behalf engages in any such practice as detailed in GCC Sub Clause 20.2.
	20.3 For the purposes of GCC Sub Clause 20.2, the terms set forth below as follows (a) "corrupt practice" means offering, giving or promising to give, receiving, or soliciting either directly or indirectly, to any officer or employee of a Employer or other public or private authority or individual, a gratuity in any form; employment or any other thing or service of value as an inducement with respect to an act or decision or

	method followed by a Employer in connection with a Procurement proceeding or Contract execution; (b) “fraudulent practice” means the misrepresentation or omission of facts in order to influence a decision to be taken in a Procurement proceeding or Contract execution; (c) “collusive practice” means a scheme or arrangement between two (2) or more Persons, with or without the knowledge of the Employer, that is designed to arbitrarily reduce the number of Tenders submitted or fix Tender prices at artificial, non-competitive levels, thereby denying a Employer the benefits of competitive price arising from genuine and open competition; or (d) “Coercive practice” means harming or threatening to harm, directly or indirectly, Persons or their property to influence a decision to be taken in the Procurement proceeding or the execution of the Contract, and this will include creating obstructions in the normal submission process used for Tenders. 20.4 Should any corrupt, fraudulent, collusive or coercive practice of any kind come to the knowledge of the Employer, it will, in the first place, allow the Contractor to provide an explanation and shall, take actions only when a satisfactory explanation is not received. Such decision and the reasons thereof, shall be recorded in the record of the procurement proceedings and promptly communicated to the Contractor. Any communications between the Contractor and the Employer related to matters of alleged fraud or corruption shall be in writing. 20.5 If corrupt, fraudulent, collusive or coercive practices of any kind determined by the Employer against the Contractor alleged to have carried out such practices, the Employer will : (a) exclude the Contractor from further participation in the particular Procurement proceeding; or (b) declare, at its discretion, the Contractor to be ineligible to participate in further Procurement proceedings, either indefinitely or for a specific period of time. 20.6 20.6 The Contractor shall be aware of the provisions on corruption, fraudulence, collusion and coercion in Section 64 of the Public Procurement Act, 2006 and Rule 127 of the Public Procurement Rules, 2008.
21. License/ Use of Technical Information	21.1 For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and non-transferable license (without the right to sub-license) to the Employer under the patents, utility models or other industrial property rights owned by the Contractor or by a third Party from whom the Contractor has received the right to grant licenses thereunder, and shall also grant to the Employer a non-exclusive and non-transferable right (without the right to sub-license) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how or other intellectual property right from the Contractor or any third Party to the Employer.

	21.2 The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third Party, including suppliers of materials, the copyright in such materials shall remain vested in such third Party.
B. Subject Matter of Contract	
22. Scope of Facilities	22.1 Unless otherwise expressly limited in the Employer's Requirements, the Contractor's obligations cover the provision of all Plant and the performance of all Installation Services required for the design, and the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Pre Commissioning and delivery) of the Plant, and the installation, completion and commissioning of the Facilities in accordance with the plans, procedures, specifications, drawings, codes and any other documents as specified in the Section, Employer's Requirements. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labor, materials, equipment, spare parts and accessories; Contractor's Equipment; construction utilities and supplies; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works and services that will be provided or performed by the Employer, as set forth in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer. 22.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract. 22.3 In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities for the period specified in the PCC and the provisions, if any, specified in the PCC. However, the identity, specifications and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in Price Schedule No.1 & 2 under form PG5A-3, which shall be added to the Contract Price. The price of such spare parts shall include the purchase price therefor and other costs and expenses (including the Contractor's fees) relating to the supply of spare parts.
23. Time for Commencement	23.1 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time stated in the PCC or within such extended time to which the Contractor shall be entitled under GCC Clause 65.1 hereof.

24. Time for Completion	24.1 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time stated in the PCCor within such extended time to which the Contractor shall be entitled under GCC Clause 65.1 hereof.
25. Employer's Responsibilities	25.1 All information and/or data to be supplied by the Employer as described in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, shall be deemed to be accurate, except when the Employer expressly states otherwise 25.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix. 25.3 The Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer). 25.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain 25.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Pre Commissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, at or before the time specified in the program furnished by the Contractor under the provisions of contract specified or as otherwise agreed upon by the Employer and the Contractor. 25.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Sub-Clause 39.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Sub-Clause 40.2. 25.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 25 shall be the responsibility of the Employer, save those to be incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Sub-Clause 40.2.

	25.8 In the event that the Employer shall be in breach of any of his obligations under this Clause, the additional cost incurred by the Contractor in consequence thereof shall be determined by the Project Manager and added to the Contract Price
26. Contractor's Responsibilities	26.1 The Contractor shall design, manufacture including associated purchases and/or subcontracting, install and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.
	26.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date twenty-eight (28) days prior to tender submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.
	26.3 The Contractor shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 25.3 hereof and that are necessary for the performance of the Contract.
27. Employer's and Contractor's Risks	27.1 The Employer carries the risks that the Contract states are Employer's risks and the Contractor carries the risks that the Contract states are Contractor's risks.
28. Employer's Risks	28.1 From the Start Date until the Defects Correction Certificate has been issued, the following are Employer's risks: (a) the risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to i. use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or ii. negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or Contracted to him except the Contractor. iii. the risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.

	28.2 From the Completion Date until the Defects Correction Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is Employer's risk, except loss or damage due to: (a) a Defect which existed on the Completion Date; (b) an event occurring before the Completion Date, which was not itself Employer's risk; or (c) the activities of the Contractor on the Site after the Completion Date.
29. Contractor's Risks	29.1 From the Start Date until the Defects Correction Certificate has been issued the risks of personal injury, death, and loss of or damage to property including without limitation, the Works, Plant, Materials, and Equipment, which are not Employer's risks are Contractor's risks.
C. Execution of the Facilities	
30. Representatives	31.1 <u>Project Manager</u> If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided. All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided. 30.2 <u>Contractor's Representative & Construction Manager</u> 30.2.1 If the Contractor's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within fourteen (14) days giving the reason therefor, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 30.2.1 shall apply thereto. 30.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract. The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall

	not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 30.2.1.
	30.2.3 . The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager. Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 30.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.
	30.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as the Construction Manager's deputy.
	30.2.5 The Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Sub-Clause 37.4. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.
	30.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 30.2.5, the Contractor shall, where required, promptly appoint a replacement.
31. Work Program	31.1 <u>Contractor's Organization</u> The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.

	31.2 <u>Program of Performance</u> Within twenty-eight (28) days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and Pre Commission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix to the Contract Agreement titled Time Schedule, and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion specified in the PCC pursuant to Sub-Clause 24.1 and any extension granted in accordance with GCC Clause 65.1, and shall submit all such revisions to the Project Manager.
	31.3 <u>Progress Report</u> The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 31.2 above, and supply a progress report to the Project Manager every month. The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.
	31.4 <u>Progress of Performance</u> If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 31.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 24.1, any extension thereof entitled under GCC Sub-Clause 65.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor. 31.5 <u>Procedures</u> The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements. The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

32. Subcontractor	32.1 Subcontracting the whole of the Plant and Service by the Contractor shall not be permissible. The Contractor shall be responsible for the acts or defaults of any Subcontractor, his or her agents or employees, as if they were the acts or defaults of the Contractor. 32.2 The Contractor shall not be required to obtain consent from the Project Manager or his representative, for suppliers solely of Materials or to a subcontract for which the Specialist Subcontractor(s) is already named in the Contract. 32.3 The prior consent, in writing, of the Engineer shall however be obtained for other proposed Subcontractor(s).
33. Nominated Subcontractor	33.1 Nominated Subcontractor named in the Contract shall be entitled to execute the specific components of the Works stated in the PCC. 33.2 The Contractor shall not be under obligations to employ a Nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars while there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength, or does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, or does not accept to enter into a subcontract which specifies that, for the subcontracted work including design, if any, the Nominated Subcontractor shall undertake to the Contractor such obligations and liabilities as will enable the contractor to discharge his or her liabilities under the Contract.
34. Other Contractors	34.1 The Contractor shall cooperate and share the Site with other Contractors, public authorities, utilities, the Engineer and the Employer between the dates given in the Schedule of other Contractors. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of other Contractors, and shall notify the Contractor of any such modification.
35. Design and Engineering	35.1 <u>Specifications and Drawings</u> 35.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice. The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer. 35.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager.

	35.2 <u>Codes and Standards</u> Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of tender submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 64. 35.3. <u>Approval/Review of Technical Documents by Project Manager</u> 35.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix to the Contract Agreement titled List of Documents for Approval or Review, for its approval or review as specified and in accordance with the requirements of GCC Sub-Clause 31.2 (Program of Performance). Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof. GCC Sub-Clauses 35.3.2 through 35.3.6 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only 35.3.2 Within fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 35.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes. If the Project Manager fails to take such action within the said fourteen (14) days, then the said document shall be deemed to have been approved by the Project Manager. 35.3.3. The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice. 35.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub-Clause 35.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved. 35.3.5 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.

	35.3.6 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Sub-Clause 35.3. If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 64 shall apply to such request.
36. Procurement	36.1 <u>Plant</u> Subject to GCC Sub-Clause 60.2, the Contractor shall procure and transport all Plant in an expeditious and orderly manner to the Site.
	36.2 <u>Employer-Supplied Plant</u> If the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply: 36.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the Parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Sub-Clause 31.2, unless otherwise mutually agreed. 36.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect or default. The Employer shall immediately remedy any shortage, defect or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody and control of the Contractor. The provision of this GCC Sub-Clause 36.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired. 36.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody and control shall not relieve the Employer of liability for any undetected shortage, defect or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 42 or under any other provision of Contract.
	36.3 <u>Transportation</u> 36.3.1 The Contractor shall at its own risk and expense transport all the materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances. 36.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment. 36.3.3 Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the Parties.

	36.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site. 36.4 <u>Customs Clearance</u> The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Sub-Clause 60.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 65.
37. Installation	37.1 <u>Setting Out/Supervision</u> 37.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks and lines provided to it in writing by or on behalf of the Employer. If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer. 37.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand. 37.2 Labor: 37.2.1 Engagement of Staff and Labor (a) Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, housing, feeding and transport. (b) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the

	Contract. The Contractor is encouraged to use local labor that has the necessary skills. (c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel. (d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor. 37.2.2 Persons in the Service of Employer The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst the Employer's Personnel. 37.2.3 Facilities for Staff and Labor Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification. The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works 37.3 <u>Contractor's Equipment</u> 37.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract. 37.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon. 37.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the

	Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.
	37.4 <u>Site Regulations and Safety</u> The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld. Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention. reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.
	37.5 <u>Site Clearance</u> 37.5.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract
	37.6 <u>Opportunities for Other Contractors</u> 37.6.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site. 37.6.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Contractor reasonable remuneration for the use of such equipment or the provision of such services.
	37.7 <u>Emergency Work</u> 37.7.1 If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Contractor shall immediately carry out such work. If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done

	by the Employer is work that the Contractor was liable to do at its own expense under the Contract. 37.7.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition. 37.8 <u>Watching and Lighting</u> The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.
38. Test & Inspection	38.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.
	38.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.
	38.3 38.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third Party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.
	38.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection. If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the Parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.
	38.5 38.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impede the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.
	38.6 If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 38.3.

	38.7	If any dispute or difference of opinion shall arise between the Parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the Parties within a reasonable period of time, it may be referred to an 72.2.
	38.8	The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.
	38.9	The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 38.4, shall release the Contractor from any other responsibilities under the Contract.
	38.10	39.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.
	38.11	The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.
	38.12	If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 38.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.
39. Completion of the Facilities	39.1	As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

	39.2 Within seven (7) days after receipt of the notice from the Contractor under GCC Sub-Clause 39.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer for Pre Commissioning of the Facilities or any part thereof. Pursuant to the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, the Employer shall also provide, within the said seven (7) day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Pre-Commissioning of the Facilities or any part thereof.
	39.3 As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters have been provided by the Employer in accordance with GCC Sub-Clause 39.2, the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Sub-Clause 40.5. 39.4 As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or
	39.5 The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 39.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Sub-Clause 39.4, or notify the Contractor in writing of any defects and/or deficiencies. If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 39.4.
	39.6 If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's repeated notice. 39.7 If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.
	39.8 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 39.4 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 39.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the

	Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be. 39.9 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor. 39.10 Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.
40. Commissioning and Operational Acceptance	40.1 <u>Commissioning</u> 40.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Sub-Clause 39.5, or immediately after the date of the deemed Completion, under GCC Sub-Clause 39.6. 40.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning. 40.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.
	40.2 Guarantee Test 40.2.1 Subject to GCC Sub-Clause 40.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test and any repeats thereof. 40.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion specified in the PCC or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Sub-Clauses 43.2 and 43.3 shall not apply. 40.3 Operational Acceptance 40.3.2 At any time after any of the events set out in GCC Sub-Clause 40.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's

	Requirements (Forms and Procedures) in respect of the Facilities or the part thereof specified in such notice as of the date of such notice. 40.3.3 The Project Manager shall, after consultation with the Employer, and within seven (7) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.
	40.3.4 If within seven (7) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.





	40.4 <u>Partial Acceptance</u> 40.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities. 40.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate 40.5 <u>Delayed Pre-commissioning and/or Guarantee Test</u> 40.5.1 In the event that the Contractor is unable to proceed with the Pre-commissioning of the Facilities pursuant to Sub-Clause 39.3, or with the Guarantee Test pursuant to Sub-Clause 40.2, for reasons attributable to the Employer either on account of non-availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Contractor's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Sub-Clause 39.6, and Operational Acceptance, pursuant to GCC Sub-Clause 40.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Sub-Clause 42.2, Functional Guarantee, pursuant to GCC Clause 43, and Care of Facilities, pursuant to GCC Clause 48, and GCC Clause 66.1, Suspension, shall not apply. In this case, the following provisions shall apply. 40.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to clauses 58 & 59, the Contractor shall be entitled to the following:

	(a) the Time of Completion shall be extended for the period of suspension without imposition of liquidated damages pursuant to GCC Sub-Clause 41.2; (b) payments due to the Contractor in accordance with the provision specified in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which would not have been payable in normal circumstances due to non-completion of the subject activities, shall be released to the Contractor against submission of a security in the form of a bank guarantee of equivalent amount acceptable to the Employer, and which shall become null and void when the Contractor will have complied with its obligations regarding those payments, subject to the provision of Sub-Clause 40.5.3 below; (c) the expenses towards the above security and extension of other securities under the contract, of which validity needs to be extended, shall be reimbursed to the Contractor by the Employer; (d) the additional charges towards the care of the Facilities pursuant to GCC Sub-Clause 48.1 shall be reimbursed to the Contractor by the Employer for the period between the notification mentioned above and the notification mentioned in Sub-Clause 40.5.4 below. The provision of GCC Sub-Clause 49.2 shall apply to the Facilities during the same period. 40.5.3 In the event that the period of suspension under above Sub-Clause 40.5.1 actually exceeds one hundred eighty (180) days, the Employer and Contractor shall mutually agree to any additional compensation payable to the Contractor. 40.5.4 When the Contractor is notified by the Project Manager that the plant is ready for Pre-commissioning, the Contractor shall proceed without delay in performing Pre-commissioning, in accordance with Clause 39.
D. Guarantees and Liabilities	
41. Completion Time Guarantee	41.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified) within the Time for Completion specified in the PCC pursuant to GCC Sub-Clause 24.1, or within such extended time to which the Contractor shall be entitled under GCC Clause 65 hereof
	41.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 65, the Contractor shall pay to the Employer liquidated damages in the amount specified in the PCC as a percentage rate of the Contract Price or the relevant part thereof. The aggregate amount of such liquidated damages shall in no event exceed the amount specified as "Maximum" in the PCC as a percentage rate of the Contract Price. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 67.2.2.

	Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 65. The Contractor shall have no further liability whatsoever to the Employer in respect thereof. However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract. Save for liquidated damages payable under this GCC Sub-Clause 41.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix to the Contract Agreement titled Time Schedule, and/or other program of work prepared pursuant to GCC Sub-Clause 31.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.. 41.3 If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 65, the Employer shall pay to the Contractor a bonus in the amount specified in the PCC. The aggregate amount of such bonus shall in no event exceed the amount specified as "Maximum" in the PCC.
42. Defect Liability	42.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant supplied and of the work executed. 42.2 The Defect Liability Period shall be five hundred and forty (540) days from the date of Completion of the Facilities (or any part thereof) or one year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the PCC pursuant to GCC Sub-Clause 42.10. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes: (a) improper operation or maintenance of the Facilities by the Employer; (b) operation of the Facilities outside specifications provided in the Contract; or (c) Normal wear and tear. 42.3 The Contractor's obligations under this GCC Clause 42 shall not apply to: (a) any materials that are supplied by the Employer under GCC Sub-Clause 36.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;

	(b) any designs, specifications or other data designed, supplied or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or (c) Any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Sub-Clause 42.7.
42.4	The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.
42.5	The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 42. The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.
42.6	If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests. If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.
42.7	If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due the Contractor or claimed under the Performance Security.
42.8	If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons.
42.9	Except as provided in GCC Clauses 42 and 49, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, or criminal or willful action of the Contractor.
42.10	In addition, any such component of the Facilities, and during the period of time as may be specified in the PCC , shall be subject to an extended

	defect liability period. Such obligation of the Contractor shall be in addition to the defect liability period specified under GCC Sub-Clause 42.2.
43. Functional Guarantees	43.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, subject to and upon the conditions therein specified. 43.2 If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 64.2.2. 43.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either (a) make such changes, modifications and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or (b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix to the Contract Agreement titled Functional Guarantees. 43.4 The payment of liquidated damages under GCC Sub-Clause 43.3, up to the limitation of liability specified in the Appendix to the Contract Agreement titled Functional Guarantees, shall completely satisfy the Contractor's guarantees under GCC Sub-Clause 43.3, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.
44. Patent Indemnity	44.1 The Contractor shall, subject to the Employer's compliance with GCC Sub-Clause 44.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.

	Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement. 44.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Sub-Clause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing. 44.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.
45. Limitation of Liability	45.1 Except in cases of criminal negligence or willful misconduct, (a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract, and (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the amount resulting from the application of the multiplier specified in the PCC, to the Contract Price or, if a multiplier is not so specified, the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement..
E. Risk Distribution	
46. Transfer of Ownership	46.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon

	loading on to the mode of transport to be used to convey the Plant from the country of origin to that country.
	46.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.
	46.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.
	46.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant in question are no longer required for the Facilities.
	46.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.
47. Care of Facilities	47.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 39 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 42. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 48.2.
	47.2 If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of
	(a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or (b) any use or occupation by the Employer or any third Party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or (c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed responsibility herein,

	47.3 the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 64. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 64, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub-Clause 66.1 hereof. 47.4 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Sub-Clause 42.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Sub-Clauses 47.2 (b) and (c).
48. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification	48.1 Subject to GCC Sub-Clause 48.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents. 48.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 48.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. 48.3 If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing. 48.4 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken

	over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 49, provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.
	48.5 The Party entitled to the benefit of an indemnity under this GCC Clause 48 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.
49. Insurance	49.1 To the extent specified in the Appendix to the Contract Agreement titled Insurance Requirements, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval. (a) <u>Cargo Insurance During Transport</u> Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the Contractor's Equipment. (b) <u>Installation All Risks Insurance</u> Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period. (c) <u>Third Party Liability Insurance</u> Covering bodily injury or death suffered by third Parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities. (d) <u>Automobile Liability Insurance</u> Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract. (e) <u>Workers' Compensation</u> In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed. (f) <u>Employer's Liability</u> In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed. (g) <u>Other Insurances</u> Such other insurances as may be specifically agreed upon by the Parties hereto as listed in the Appendix to the Contract Agreement titled Insurance Requirements. 49.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Third Party Liability, Workers' Compensation and Employer's

	Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1 except for the Cargo Insurance during Transportation, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. 49.3 The Contractor shall, in accordance with the provisions of the Appendix to the Contract Agreement titled Insurance Requirements, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy. 49.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor. 49.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix to the Contract Agreement titled Insurance Requirements, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insured under all such policies. All insurers' rights of subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than twenty-one (21) days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Sub-Clause 49.5. 49.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 49.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due to the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 49.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein. 49.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies affected by it pursuant to this GCC Clause 49, and all monies payable by any insurers

	shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.
50. Unforeseen Conditions	50.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing beforehand: (a) the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen; (b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions; (c) the extent of the anticipated delay; and (d) the additional cost and expense that the Contractor is likely to incur.) On receiving any notice from the Contractor under this GCC Sub-Clause 50.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken. 50.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Sub-Clause 50.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price. 50.3 If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Sub-Clause 50.1, the Time for Completion shall be extended in accordance with GCC Clause 60.
51. Change in Laws and Regulation	51.1 Unless otherwise specified in the Contract, if after the Contract, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in Bangladesh (which shall be deemed to include any change in interpretation or application by the

	competent authorities) that subsequently affects the Delivery Date and/or the Contract Price, then such Delivery Date and/or Contract Price shall be correspondingly increased or decreased, to the extent that the Supplier has thereby been affected in the performance of any of its obligations under the Contract.
52. Force Majeure	52.1 In this Clause, “Force Majeure” means an exceptional event or circumstance: (a) which is beyond a Party’s control; (b) which such Party could not reasonably have provided against before entering into the Contract; (c) which, having arisen, such Party could not reasonably have avoided or overcome; and (d) which is not substantially attributable to the other Party.
	52.2 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied: (i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies; (ii) rebellion, terrorism, sabotage by persons other than the Contractor’s Personnel, revolution, insurrection, military or usurped power, or civil war; (iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor’s Personnel; (iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor’s use of such munitions, explosives, radiation or radio-activity, and (v) natural catastrophes such as cyclone, hurricane, typhoon, tsunami, storm surge, floods, earthquake, landslides, fires, epidemics, quarantine restrictions, or volcanic activity; (vi) freight embargoes; (vii) acts of the Government in its sovereign capacity.
53. Notice of Force Majeure	53.1 If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure
	53.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.
	53.3 Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.
54. Duty to Minimize Delay	54.1 Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure.
	54.2 A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

55. Consequences of Force Majeure	55.1 The Contractor shall not be liable for forfeiture of its Performance Security, liquidated damages, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure: 55.2 The Employer may suspend the delivery or contract implementation, wholly or partly, by written order for a certain period of time, as it deems necessary due to force majeure as defined in the contract. 55.3 Delivery made either upon the lifting or the expiration of the suspension order. However, if the Employer terminates the contract as stated under GCC clause 66, resumption of delivery cannot be done. 55.4 The Employer determines the existence of a force majeure that will be the basis of the issuance of suspension of order.
F. Payment	
56. Contract Price	56.1 The Contract Price shall be paid as specified in the Contract Agreement Form PG5A- 8. 56.2 Unless an adjustment clause is provided for in the PCC, the Contract Price shall be a firm lump sum not subject to any alteration, except in the event of a Change in the Facilities or as otherwise provided in the Contract. 56.3 Subject to GCC Sub-Clauses 25.2, 26.1 and 50 hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract. 56.4 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the PCC. If so provided, the amounts as certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amount. The generic formula indicated below in the form as specified in the PCC applies: $P = A + B (I_m/I_o)$ 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 I_m is the Index during the month the work has been executed and I_o is the Index prevailing twenty eight (28) days prior to the deadline for submission of Tender. The Indexes to be used is as published by the Bangladesh Bureau of Statistics (BBS) on a monthly basis. In case not available, then other countries or authorities of the sources mentioned in Appendix to the Tender may be used. 56.5 If the value of the Index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next or in the final payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.

57. Terms of Payment	57.1 The Contract Price shall be paid as specified in the Contract Agreement and in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which also outlines the procedures to be followed in making application for and processing payments. 57.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof. 57.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendices to the Contract Agreement titled Terms and Procedures of Payment, for the period of delay until payment has been made in full, whether before or after judgment or arbitrage award. 57.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendices to the Contract Agreement titled Terms and Procedures of Payment, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's tender.
58. Advance Payment Security	58.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix to the Contract Agreement titled Terms and Procedures of Payment, and in the same currency or currencies. 58.2 The security shall be in the form provided in the tender documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.
59. Performance Security	59.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security for the due performance of the Contract in the amount specified in the PCC. 59.2 The performance security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in the form provided in Section 5, Tender and Contract Forms, corresponding to the type of bank guarantee stipulated by the Employer in the PCC, or in another form acceptable to the Employer. 59.3 Unless otherwise specified in the PCC, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, five hundred and forty (540) days after Completion of the Facilities or three hundred and sixty five (365) days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 42.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 42.10, is liable for an extended defect liability obligation, the performance

	security shall be extended for the period specified in the PCC pursuant to GCC Sub-Clause 42.10 and up to the amount specified in the PCC. 59.4 The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract. The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.
60. Taxes and Duties	60.1 The Contractor shall be entirely responsible for all kinds of taxes, duties, fees, levies, and such other charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located. 60.2 Notwithstanding GCC Sub-Clause 60.1 above, the Employer shall bear and promptly pay (a) all customs and import duties for the Plant specified in Price Schedule No. 1; and (b) other domestic taxes such as, sales tax and value added tax (VAT) on the Plant specified in Price Schedules No. 1 and No. 2 and that is to be incorporated into the Facilities, and on the finished goods, imposed by the law of the country where the Site is located. 60.3 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
61. Payments to Nominated Subcontractor(s)	61.1 The Contractor shall pay to the Nominated Subcontractor(s) the amounts shown on the Nominated Subcontractor's invoices approved by the Contractor in accordance with the subcontract included under the Contract.
62. Price Adjustment	62.1 Where the Contract Period (excluding the Defects Liability Period) exceeds eighteen (18) months, it is normal procedure that prices payable to the Contractor shall be subject to adjustment during the performance of the Contract to reflect changes occurring in the cost of labour and material components. In such cases the tender documents shall include in the Appendix 2, a formula of such price adjustment. 62.2 Where Contracts are of a shorter duration than eighteen (18) months or in cases where there is to be no Price Adjustment, the following provision shall not be included. Instead, it shall be indicated under this Appendix 2 that the prices are to remain firm and fixed for the duration of the Contract. 62.3 If the value of the Index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next or in the final payment certificate. The Index value shall be deemed to take account of all changes in price due to fluctuations.

63. Liquidated Damages	63.1 The Contractor shall be liable to pay Liquidated Damages or in other words the Delay Damages to the Employer at the rate per day as specified in the PCC for each day of delay from the Intended Completion Date, for the uncompleted delivery of goods/works/services or for any part thereof. 63.2 The total amount of Liquidated Damages shall not exceed the amount defined in the PCC. 63.3 Once the cumulative amount of Liquidated Damages reaches ten (10) percent of the Contract price, the Employer may rescind the Contract, without prejudice to other courses of action and remedies open to it. 63.4 The amount of Liquidated Damages may be deducted from any money due or which may become due to the Contractor under the Contract and/or collect such amount of Liquidated Damages from the Retention Money (if any) or other securities posted by the Contractor whichever is convenient to the Employer. In an extreme situation that no such foregoing recourse is available, the contractor be asked to make good the damages from his own finances in writing failing which necessary action as per the provisions of this GCC or PCC be taken. 63.5 Payment of Liquidated Damages by the Contractor shall not relieve the Contractor from its obligations. 63.6 If the Intended Completion Date is extended after Liquidated Damages have been paid, the Engineer shall correct any overpayment of Liquidated Damages by the Contractor by adjusting the next payment certificate.
G. Change in Contract Elements	
64. Change in the Facilities	64.1 <u>Introducing a Change</u> 64.1.1 Subject to GCC Sub-Clauses 64.2.5 and 64.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Facilities hereinafter called “Change”, provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract 64.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer with a copy to the Project Manager, any Change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor, provided that the Employer shall approve any Change proposed by the Contractor to ensure the safety of the Facilities. 64.1.3 Notwithstanding GCC Sub-Clauses 64.1.1 and 64.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

	64.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 64.2 and 64.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures). 64.2 <u>Changes Originating from Employer</u> 64.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 64.1.1, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a "Change Proposal," which shall include the following: (a) brief description of the Change (b) effect on the Time for Completion (c) estimated cost of the Change (d) effect on Functional Guarantees (if any) (e) effect on the Facilities (f) effect on any other provisions of the Contract. 64.2.2 Prior to preparing and submitting the "Change Proposal," the Contractor shall submit to the Project Manager an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal. Upon receipt of the Contractor's Estimate for Change Proposal, the Employer shall do one of the following: (a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal (b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate (c) advise the Contractor that the Employer does not intend to proceed with the Change. 64.2.3 Upon receipt of the Employer's instruction to proceed under GCC Sub-Clause 64.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Sub-Clause 64.2.1. 64.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change

	.64.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 64 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen percent (15%), the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer shall withdraw the proposed Change and shall notify the Contractor in writing thereof. The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.
	64.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order. If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision. If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Sub-Clause 64.2.2. 64.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."
	Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The Parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

	64.3 Changes Originating from Contractor 64.3.1 If the Contractor proposes a Change pursuant to GCC Sub-Clause 64.1.2, the Contractor shall submit to the Project Manager a written “Application for Change Proposal,” giving reasons for the proposed Change and including the information specified in GCC Sub-Clause 64.2.1. Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GCC Sub-Clauses 64.2.6 and 64.3.2. However, should the Employer choose not to proceed, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.
65. Extension of Time for Completion	65.1 The Time(s) for Completion specified in the PCC pursuant to GCC Sub-Clause 8.2 shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following: (a) any Change in the Facilities as provided in GCC Clause 64 (b) any occurrence of Force Majeure as provided in GCC Clause 52, unforeseen conditions as provided in GCC Clause 50, or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clause 47.2 (c) any suspension order given by the Employer under GCC Clause 41 hereof or reduction in the rate of progress pursuant to GCC Sub-Clause 66.2 or (d) any changes in laws and regulations as provided in GCC Clause 51 or (e) any default or breach of the Contract by the Employer, Appendix to the Contract Agreement titled ,or any activity, act or omission of the Employer, or the Project Manager, or any other contractors employed by the Employer, or (f) any delay on the part of a sub-contractor, provided such delay is due to a cause for which the Contractor himself would have been entitled to an extension of time under this sub-clause, or (g) delays attributable to the Employer or caused by customs, or (h) any other matter specifically mentioned in the Contract by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

	65.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract. In all cases where the Contractor has given a notice of a claim for an extension of time under GCC 65.2, the Contractor shall consult with the Project Manager in order to determine the steps (if any) which can be taken to overcome or minimize the actual or anticipated delay. The Contractor shall there after comply with all reasonable instructions which the Project Manager shall give in order to minimize such delay. If compliance with such instructions shall cause the Contractor to incur extra costs and the Contractor is entitled to an extension of time under GCC 65.1, the amount of such extra costs shall be added to the Contract Price.
66. Suspension	66.1 The Employer may request the Project Manager, by notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons thereof. The Contractor shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Facilities, until ordered in writing to resume such performance by the Project Manager.. If, by virtue of a suspension order given by the Project Manager, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than ninety (90) days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within twenty-eight (28) days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 64, excluding the performance of the suspended obligations from the Contract. If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 64 or, where it affects the whole of the Facilities, as termination of the Contract under GCC Sub-Clause 66.1 66.2

	(a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 57.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice or (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Sub-Clause 25.2, or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities, then the Contractor may by fourteen (14) days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress. 66.3 If the Contractor's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GCC Clause 66, then the Time for Completion shall be extended in accordance with GCC Sub-Clause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract. 66.4 During the period of suspension, the Contractor shall not remove from the Site any Plant, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.
H. Termination and Settlement of Disputes	
67. Termination	67.1 <u>Termination for Default</u> (a) The Employer or the Contractor, without prejudice to any other remedy for breach of Contract, by giving twenty eight (28) days written notice of default to the other party, may terminate the Contract in whole or in part if the other party causes a fundamental breach of Contract. (b) Fundamental breaches of the Contract shall include, but shall not be limited to, the following:

	(i) the Contractor stops work for twenty-eight (28) days when no stoppage of work is shown on the current Programme and the stoppage has not been authorized by the Engineer; (ii) the Engineer instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within twenty-eight (28) days; (iii) the Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer; (iv) the Engineer gives Notice that the failure to achieve the progress in accordance with the updated Programme of Works by the Contractor is a non-fulfilment of contractual obligations and the Contractor fails to restore it within a reasonable period of time instructed by the Engineer; (v) the Contractor does not maintain a Security, which is required; (vi) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of Liquidated Damages can be paid, as specified in GCC Sub Clause 41.2; (vii) the Contractor has subcontracted the whole of the Works or has assigned the Contract without the required agreement and without the approval of the Engineer; (viii) the Contractor, in the judgment of the Employer has engaged in practices, as defined in GCC Sub Clause 39, in competing for or in executing the Contract. (c) A payment certified by the Engineer is not paid by the Employer to the Contractor within twenty eight (28) days of the date of the Engineer's certificate. 67.2 <u>Termination for Insolvency</u> The Employer and the Contractor may at any time terminate the Contract by giving twenty eight (28) days written notice to the other party if either of the party becomes bankrupt or otherwise insolvent. In such event, termination will be without compensation to any party, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the other party. 67.3 <u>Termination for Convenience</u> (a) The Employer, by giving twenty eight (28) days written notice sent to the Contractor, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Employer's convenience, the extent to which performance of the Contractor under the Contract is terminated, and the date upon which such termination becomes effective. The termination shall take effect twenty eight (28) days after the later dates on which the Contractor receives this notice or the Employer returns the Performance Security. (b) The Employer shall not terminate the contract under GCC Sub Clause 67.1 (a) in order to execute the contract itself or to arrange for the

	Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor as stated under GCC Sub Clause 67.1(a). 67.4 In the event the Employer terminates the Contract in whole or in part, the Employer shall accept the portion of the Works that are complete and ready for handing over after the Contractor's receipt of notice of termination of the Contract. For the remaining portion of the Works, the Employer may elect: (a) to have any portion completed by the Contractor at the Contract terms and prices; and /or (b) to cancel the remainder and pay to the Contractor an agreed amount for partially completed Works and for materials and parts previously procured by the Contractor, or (c) except in the case of termination for convenience as stated under GCC Sub Clause 67, engage another Contractor to complete the Works, and in that case the Contractor shall be liable to the Employer for any cost that may be incurred in excess of the sum that would have been paid to the Contractor, if the work would have been executed and completed by him or her. 67.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as is reasonably possible
68. Payment upon Termination	68.1 If the Contract is terminated because of a fundamental breach of Contract under GCC Sub Clause 67.1 by the Contractor, the Project Manager shall issue a certificate for the value of the Works done and Plant and Materials ordered less advance payments received up to the date of the issue of the certificate and less the amount from percentage to apply to the contract value of the works not completed, as indicated in the PCC. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer. 68.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a payment certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's foreign personnel employed solely on the Works and recruited specifically for the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate. 68.3 If the Contract is terminated for reasons of Force Majeure, the The Project Manager shall determine the value of the work done and issue a Payment Certificate which shall include. (a) the amounts payable for any work carried out for which unit rates or prices are stated in the Contract; (b) the cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by

	the Employer, and the Contractor shall place the same at the Employer's disposal; (c) other costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works; (d) the cost of removal of Temporary Works and Contractor's Equipment from the Site; and (e) the cost of repatriation of the Contractor's staff and labor employed wholly in connection with the Works at the date of termination.
69. Property	69.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default stated under GCC Sub Clause 67.1.
70. Frustration	70.1 If the Contract is frustrated by the occurrence of a situation of Force Majeure as defined in GCC Sub Clause 52, the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any work carried out afterwards to which a commitment was made.
I. Claims, Disputes and Arbitration	
71. Contractor's Claims	71.1 If the Contractor considers himself to be entitled to any extension of the Completion Time and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Employer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than twenty eight (28) days after the Contractor became aware, or should have become aware, of the event or circumstance. 71.2 If the Contractor fails to give notice of a claim within such period of twenty eight (28) days, the Intended Completion Date shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. 71.3 Within forty two (42) days after the Contractor became aware or should have become aware of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed, for settlement.

72. Settlement of Disputes	<u>Amicable settlement</u> 72.1 The Employer and the Contractor shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract. <u>Arbitration</u> 72.2 If, after twenty-eight (28) days, the parties have failed to resolve their dispute or difference by such mutual consultation as stated under GCC Clause 72.1, then either the Employer or the Contractor may give notice to the other party of its intention to commence arbitration in accordance with GCC Sub Clause 72.3, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. Any dispute or difference in respect of which a notice of intention to commence arbitration has been given in accordance with this Clause shall be finally settled by arbitration. 72.3 Arbitration shall be commenced prior to or after execution of the Works under the Contract. Arbitration proceedings shall be conducted in accordance with the rules of procedure specified in the PCC. 72.4 Notwithstanding any reference to arbitration hereinabove the parties shall continue to perform their respective responsibilities under the Contract unless agreed otherwise and, the Employer shall pay any monies due to the Contractor.





Section 4. Particular Conditions of Contract

Instructions for completing the Particular Conditions of Contract are provided in italics in parenthesis for the relevant GCC Clauses.	
GCC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract
GCC 1.1(j)	The Contractor is <i>[Name, address, and name of authorized representative]</i>
GCC 1.1(II)	The Procuring Entity/Employer/Purchaser/Project Manager/Consignee is: Northern Electricity Supply PLC Representative: Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd Supplier: Also means Contractor Provisional Acceptance Certificate (PAC): Also means Operational Acceptance Certificate (OAC).
GCC 1.1(oo)	The Site is located at Sherpur 132/33 Grid Substation, Bogura.
GCC 3.1	The Procuring Entity's address for the purpose of communications under this contract is : Superintending Engineer (Procurement), NESCO, Bidyut Bhaban, Hetem khan, Rajshahi, Bangladesh. Telephone: +880 1709-996752 e-mail: se.procurement@nesco.gov.bd The Contractor's address for the purpose of communications under this contract is : Contact person: Address: Tel: Fax: e-mail address:
GCC 6.1 (k)	Other documents forming part of the Contract are: Site Investigation Reports, Acceptance of NOA, Performance Security and All Correspondences between purchaser and Contractor prior to signing of the contract agreement.
GCC 9.2	Materials, Equipment Plants and supplies shall not have their origin in the following countries: Israel Plant and services from a country which is not included in the specified countries mentioned in the respected GTP in Section 8: Guaranteed Technical Particulars is also not acceptable.

GCC 13.1	Possession of the Site or part(s) of the Site, to the Contractor shall be given on the following date(s); within 14 days of contract signing.
GCC 22.3	The Contractor agrees to supply spare parts for a period of 5 years .
GCC 23.1	Replace Clause as follows: The Contractor shall commence work on the Facilities within 14 (Fourteen) days from the “Effective Date” and without prejudice to GCC Sub-clause 41.2 hereof, the Contractor shall thereafter proceed with Facilities in accordance with the Time schedule specified in the Appendix 4 (Time Schedule) to the Contract Agreement. N.B. The “Effective Date” shall be the date of contract is signed.
GCC 24.1	The time for completion of the whole of the facilities within 365 days from the effective date as described in the contract agreement.
GCC 32.1	A Subcontractor that is a national of, or registered in, the following countries are not eligible: Israel
GCC 33.1	Nominated Subcontractor(s) named below: Not Applicable
GCC 35.4	SUBMISSION OF “As-built” Drawing of the Plant: The Contractor shall submit “As-built” drawing including Approval/ Testing Report/ Operational & Maintenance Manual within one month from the date of Completion. All documents including Drawing/ Testing Report/ Operational & Maintenance Manual must be submitted in English language. If the Contractor does not supply the Drawings and Manuals by the dates specified above or they do not follow good engineering comments/suggestions given by the Design & Inspection Department of NESCO, Operational Acceptance Certificates (OAC) or FAC shall not be issued until the submission of “As-built” drawings and operating and maintenance manuals.
GCC 37.5.2	CLEAN UP OF SITE: The Contractor shall clean the working areas periodically of all trash and waste materials and shall maintain the Site in a neat and orderly condition throughout the construction period. The Engineer shall have the right to determine what is waste material or rubbish and the manner and place of disposal. On or before the completion of the Work the Contractor shall, without charge there for, carefully clean out all pits, pipes, chambers or conduits, and shall tear down and remove all temporary structures built by him, and shall remove all rubbish of every kind from the tracts or grounds which he has occupied and shall leave them in first class condition. In the event that the Contractor fails to comply with the cleanliness requirement or to perform the clean-up work assigned to him by NESCO. NESCO will reserve the right to hire labor to perform the necessary cleaning work and the Contractor shall bear all the cost regarding such clean-up work.
GCC 38.2 & GCC 38.8	<u>Testing, Training & Inspection:</u> <u>(A) Inspection, Testing of the Equipment (Pre-Shipment Inspection)/ Witnessing of the manufacturing Process Technical Know-How:</u> Inspection & testing of different substation equipment at manufactures premises will be conducted by the NESCO Engineers according to section 6/7/8/9 and appendixes of this tender document. Total Three (03) inspection groups each consisting of three (03) NESCO Engineers will conduct the pre-shipment inspection (Technical Orientation and Quality Test Witness at

	the manufacturer's factory premises) of the equipment as mentioned section 7. PE reserves the right to revise the clusters of these Three (03) equipment groups for Inspection depending on the country of origin of the goods. For foreign manufacture the Contractor shall bear the round air tickets, hotel accommodations, foods, per diem allowances, internal transportations and out of pocket expenses @ US\$ 100.00 per person per day for 7 (Seven) days (excluding travel time) for such inspections. No goods shall be packed, prepared for shipment/delivery unless the inspection (PSI) report has been approved and written instruction has been issued by the Purchaser. The Contractor shall bear all costs regarding all testing and inspection. N.B. Third Party Inspection: a) For any reason, if purchaser's representative(s) cannot attend above mentioned "Witnessing of manufacturing process and tests of the equipment at manufacturers works including transfer of technical know-how" program, a Third Party Inspection Company/Agency shall conduct/ witness Pre-shipment Inspection as well as Factory Acceptance Tests as per Contract and relevant standard at the manufacturer's Premises with the concurrence of NESCO The Third Party Inspector shall submit a comprehensive report to purchaser with recommendation accompanied with photograph and video clips with date and time of the Equipment/Materials/Goods inspected within 7 days after completion of respective inspection/Test. After approval of third party Inspection report by NESCO, shipping advice shall be issued to Supplier/Contractor. No Equipment/Materials/Goods shall be shipped without shipping advice. b) The inspections/Tests shall be performed on as-needed basis as per schedule provided by the respective manufacturers. c) Supplier/contractor/manufacturer shall not claim any additional cost for third party inspection. But if the cost is less than the regular cost of PSI/FAT by NESCO's representatives, then the excess bill will be deducted from final bill. d) The third party inspection company/agency must not be involved in design, procurement, fabrication, construction and installation under this contract e) Contractor/Supplier shall propose any of the following companies/agencies as Third Party Inspector: 1. BUREAU VERITAS 2. SGS 3. Black and Veatch 4. Mott MacDonald 5. TUV SUD 6. Lloyd Inspection Agency 7. Intertek group 8. Any other internationally accredited, independent & reputed inspection company/agency with global presence having minimum 05 years experiences as third party inspection company/agency and related activities in the major Engineering Industries can be selected. In addition, Inspection Company / agency must be a member of the International federation of inspection agency (IFIA)/ TIC Council must have valid accreditation certificate for ISO 9001 and ISO/IEC 17020 and experience in successful completion of the similar test activities for relevant item. f) With the approval of NESCO, contractor/supplier shall engage third party inspection company/agency. The Third Party Inspection is applicable for Equipment/Materials/Goods manufactured outside Bangladesh. NESCO reserves the right to revise the above mentioned list. Nothing in this clause shall in any way release the supplier from any warranty or other obligation under the provisions of the contract/ purchase order.
GCC 40.1.2	Replace the Clause as follows: Before commissioning, the Employer will provide operating and maintenance personnel under Contractor's supervision to get them (Employer's O&M personal) acquainted with and to witness the commissioning of the Plant & Equipment. All raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning shall be supplied by the Contractor.
GCC 40.2.2	The Guarantee Test of the Facilities shall be successfully completed within 30 days from the date of Completion.

GCC40.3.1	Subjected to GCC Sub-Clause 40.4 below, Operational Acceptance shall occur in respect of Facilities or any part thereof when a. the Guarantee Test has been successfully completed and the Functional Guarantee are met; or b. the Guarantee Test has not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the period from the date of Completion or any other agreed upon period as specified in GCC Sub-Clause 40.2.2 or c. the Contractor has paid the liquidated damages specified in GCC Sub-clause 43.3 for Functional Guarantee hereof; and d. any minor items mentioned in GCC Sub-Clause 39.9 hereof relevant to the Facilities or that part thereof have been completed; and e. successfully carry out the Technical Orientation and Quality Test Witness of Plant & Equipment and any part of the Facilities specified hereof;
GCC 41.3	No bonus will be given for earlier Completion of the Facilities or part thereof.
GCC42.2	Replace the first Paragraph of clause 42.2 as follows: The warranty/defect liability period hereunder shall begin from the date of issuance of Operational Acceptance Certificate (OAC)/ Provisional Acceptance Certificate (PAC) by NESCO and shall end after 12 (Twelve) months pursuant to GCC Sub-Clause 42.10.
GCC 42.3	<u>Liquidated Damages:</u> The Contractor shall be liable to pay Liquidated Damages or in other words the Delay Damages to the Employer at the rate per day at the rate zero-point one percent (0.1%) for each day of delay from the Intended Completion Date, for the uncompleted delivery of goods/works/services or for any part thereof. The maximum amount of Liquidated Damages is: Ten percent (10%) of the final Contract price.
GCC 42.10	During the Defect Liability Period, if any Equipment is damaged and replaced by the Contractor, fresh Defect Liability Period for 12 (Twelve) months of operation shall be counted for replaced Equipment from the date of repair, replacement, commissioning thereof.
GCC 42.11	Final Acceptance Certificate (FAC): The “Final Acceptance Certificate (FAC)” shall mean the official notification by Employer to the Contractor, issued at the end of all the Defect Liability Period (if different guarantee periods to different parts of the work, after the expiration of the latest of such periods) which indicates that the Contractor has completed his obligation under the Contract.
GCC 45.1 (b)	The multiplier of the Contract Price is: 1 (one)
GCC 47.1	Updated as follows: The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Operational Acceptance of the Facilities pursuant to GCC Clause 40.3 or, where the Contract provides for Completion of the Facilities in parts, until the date of Operational Acceptance of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out,

	pursuant to GCC Clause 42. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 47.2.
GCC 56.2	The Contract Price shall be adjusted in accordance with the provisions of the Appendix to the Contract Agreement titled Adjustment Clause. – Not Applicable
GCC 56.4	Prices shall not be adjusted for fluctuations in the cost of inputs.
GCC 57.5	Payments due to the Contractor in each certificate shall be made into the following Bank Account nominated by the Contractor and in the currency as specified in the Payment Schedule: The particulars of the Bank Account nominated are as follows : Title of the Account: [insert title to whom the Contract awarded] Name of the Bank : [insert name with code, if any] Name of the Branch : [insert branch name with code ,if any] Account Number : [insert number] Address : [insert location with district] Tel: Fax: e-mail address:
GCC59.1	The Contractor shall, within twenty-eight (28) days of the notification of contract award (NOA), provide a security for the due performance of the Contract in the amount, as a percentage of the Contract Price for the Facility or for the part of the Facility for which a separate Time for Completion is provided, shall be: Ten percent (10%).
GCC59.2	The performance security shall be provided in the currency or currencies of the Contract as stated under ITT Sub Clauses 27.4 at the percentage as specified in GCC 59.1 and shall be in the form of an irrevocable Bank Guarantee in the Format (Form PG5A-9) provided in Section 5, Tender and Contract Forms, acceptable to the Employer.
GCC59.3	Performance Security shall not be reduced. The performance security shall be valid until completion of Defects Liability Period plus 28 (twenty-eight) days, provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 42.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 42.10, is liable for an extended defect liability obligation, the performance security shall be extended for the period specified in the PCC pursuant to GCC Sub-Clause 42.10 and up to the amount specified in the PCC.
GCC 63.1 & GCC63.2	As in GCC 41.2

Appendix to the Tender

[In Tables below, the Procuring Entity shall indicate the source and base values with dates of Indexes, unless otherwise instructed to be quoted by the Tenderer, for the different Cost Components and mention its Weightings or Coefficients]

Table 1.1: Price Adjustment Data: Not Applicable

[ITT Sub Clause 26.9: To be provided by the Procuring Entity]

Index Descriptions	Base Value	Sources of Index

Note:

1. The sources of Indexes and its values with dates shall be Bangladesh Bureau of Statistics (BBS) unless otherwise mentioned by the Procuring Entity or instructed to be quoted by the Tenderer.
2. The Procuring Entity may require the Tenderer to justify its proposed Indexes, if quoted by the Tenderer.
3. The Base Value of the Indexes shall be those prevailing twenty eight (28) days prior to the deadline for submission of the Tenders.



Table 1.2: Price Adjustment Data: Not Applicable

[GCC Sub Clause 56.4: To be provided by the Procuring Entity]

Item Group	Bill No. if applicable	Index Descriptions	Coefficients or Weightings for non-adjustable Cost Component	Coefficients or Weightings for adjustable Cost Components										Total
				a	B	C	D	E	f	g	h	I	j	
														1
														1
														1
														1
														1
														1

Note:

The Weightings or Coefficients of the Cost Components shall be mentioned by the Procuring Entity based on the proportion of components involved in the items caused to be impacted by rise and fall in its prices.

APPENDICES [This appendixes shall be the part of the contract]

Appendix 1 - Terms and Procedures of Payment

Appendix 2 - Price Adjustment

Appendix 3 - Insurance Requirements

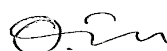
Appendix 4 - Time Schedule

Appendix 5 - List of Major Items of Plant and services and List of Approved Subcontractors

Appendix 6 - Scope of Works and Supply by the Employer

Appendix 7 - List of Documents for Approval or Review

Appendix 8 - Functional Guarantees



Appendix 1. Terms and Procedures of Payment

The following Terms and Procedures of Payment are given as a guideline suitable for Supply and Installation Contracts. In the event that the Employer wishes to introduce different terms of payment to the following, it shall first obtain the written approval of the Procuring Entity/authority as deemed appropriate, if beyond the financial power, for the terms it intends to use. If additional Price Schedules are introduced, suitable terms of payment in respect of such additional schedules must be added.

In accordance with the provisions of GCC Clause 57 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on Price Schedules. Payments will be made in the currencies quoted by the Tenderer unless otherwise agreed between the parties. Applications for payment in respect of part deliveries may be made by the Contractor as work proceeds.

(A) Terms of Payment

Schedule No. 1: Not Applicable

Schedule No. 2

- i) **Advance Payment:** N/A
- ii) **On Delivery to the Site:** Fifty percent (50%) of the total payment (delivered goods) will be made upon delivery of the product at the Bay location and approval of Post-delivery Inspection.
- iii) **On Completion Certificate:** Twenty percent (25%) payment shall be made after the issuance of the Completion Certificate, as specified in GCC Clause 39, and upon submission of the claim bill duly certified by the PE.
- iv) **On Operational Acceptance Certificate:** Twenty percent (25%) payment shall be made after the issuance of the Operational Acceptance Certificate (OAC) as specified in GCC 40.3 and upon submission of the claim bill duly certified by the PE.

Schedule No. 3- Design Services

Hundred percent (100%) payment shall be made after the issuance of the Operational Acceptance Certificate (OAC) and upon submission of "As built" of design duly certified and approved by the PE.

Schedule No. 4– Civil Works

- i. **Advance Payment:** Not Applicable
- ii. **On Progress Report: Seventy percent (70%)** of the measured value of work performed satisfactorily by the Contractor, as identified in the said Program of Performance or in Contractors' breakdown estimate, will be made progressively after receipt of invoice/claim bill duly certified by the PE.

- iii. **On Operational Acceptance Certificate /PAC:** Thirty percent (30%) of the total value of work performed satisfactorily by the Contractor as identified in the said Program of Performance or in Contractors' breakdown estimate, upon issuance of the Operational Acceptance Certificate (OAC) as specified in GCC40.3, will be made after receipt of invoice/claim bill duly certified by the PE.

Note 1: The Payment-delay period after which the Purchaser shall pay interest to the Contractor/Supplier shall not be allowed. No interest will be applicable for delayed payment.

Schedule No. 5 - Installation and other Services

In respect of installation services, the following payments shall be made:

- i. **Advance Payment: Not Applicable**
- ii. **On Progress Report: Not Applicable**

On Operational Acceptance Certificate /PAC: Hundred percent (100%) of the total value of work performed satisfactorily by the Contractor as identified in the said Program of Performance or in Contractors' breakdown estimate, upon issuance of the Operational Acceptance Certificate (OAC) as

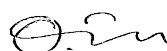
(B) Payment Procedures

The procedures to be followed in applying for certification and making payments shall be as follows:

Payment (where applicable) shall be made direct through transfer of fund to Contractor's account or through cheque. Payment shall be made direct from NESCO.

(A) Payment Procedure for monthly Progress Report against Civil work:

On or about the first day of each month the Contractor will prepare a bill in prescribed form of the value (As per Breakdown estimate submitted by Contractor) for the Civil work done up-to such date. The estimated cost of Civil work which, do not conform to the specifications will be deducted from the billed amount. Payment will be made to the Contractor as stipulated above. Such intermediate payment shall be regarded as payment by way of advance against the final payment for work actually done and shall not preclude the requiring of bad, unsound and imperfect work to be removed and reconstructed. Such payments shall not be considered as admission that the Contract performance has been completed nor shall it indicate the accruing or any claim, or shall it conclude, determine or affect in any way the powers of NESCO under this Contract to final settlement and adjustment of the account or in any other way vary or affect the Contract.



Contractor's Breakdown Estimate

The Contractor shall prepare and submit to the Consignee for approval a breakdown estimates for and covering each lump-sum price stated in the Contract. The breakdown estimate, showing the value of each kind of work/service shall be certified and approved by before any partial payment estimate is prepared. Such items as bond premium, temporary facilities and plant may be listed separately in the breakdown estimate, provided that their cost can be substantiated.

The sum of the items listed in any breakdown estimate shall equal the Contract lump-sum price or prices, overhead and profit shall not be listed as separate items.

Documentation for progress payments shall be supported by the following documents:

- (a) One counterpart of a Work Progress Certificate signed by the Contractor and jointly countersigned by the Owner's Engineer and the Project Manager.
- (b) The Contractor shall submit all Work Progress Certificates to both the Owner's Engineer and the Project Manager simultaneously by registered air mail. The Owner's Engineer and the Project Manager will either countersign or reject a Work Progress Certificate within a maximum period of thirty (30) days from the date of receipt of such Certificate by him. If the Owner's Engineer and the Project Manager or either shall fail either to countersign or to reject a Work progress Certificate within the said thirty (30) days period, the Contractor shall notify the Project Manager by mentioning cause of the delay in the approval from the Site; and the Project Manager will either countersign the Work Progress Certificate in question or assign his reasons for not doing so within a maximum period of sixty (60) days from the date of receipt of the Contractor's said notice to him.
- (c) The Contractor shall furnish to the Project Manager and the Owner's Engineer or either whenever called upon to do so any additional information or documents that may be required in connection with verification of progress claims and or any other payments made.

Appendix 2. Price Adjustment: Not Applicable

Prices payable to the Contractor, in accordance with the Contract, shall be subject to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula:

The Contract is subject to price adjustment applying the following formulae and the weightings or coefficients :

[Price Adjustment Formulae to be applicable if stated under ITT Sub Clause 26.9 shall be specified here]

Example:

$$P = A + a (Lm/Lo) + b (BIm/BIo) + c (CEm/CEo) + d (RSm/RSo) + e (STm/STo) + f (BRm/BRo) + g (MIm/MIo) + h (FUm/FUo) + \text{etc}$$

where;

L= Labor, BI=Bitumen, CE=Cement, RS=Reinforcing Steel, ST=Stone, BR=Bricks, MI=Miscellaneous, FU= Fuel]

Weighting or Coefficient A equals between 0.10 and 0.15 and, B (a+b+c+d+e+f+g+h+etc) equals between 0.90 and 0.85.

[insert figure] non-adjustable component (**coefficient A**)

[insert figure] adjustable component (**coefficient B**)

[The sum of A+B shall equal ONE (1). It is usual to have value of A between 0.10 and 0.15 and that of B between 0.90 and 0.85. Breakdown of B shall be provided in Appendix to the Tender.]

[delete as appropriate]

The date of adjustment shall be the mid-point of the period of manufacture or installation of component or Plant.

The following conditions shall apply:

- (a) No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.
- (c) No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.

For complex plant supply and installation involving several sources of supply and/or a substantial amount of installation works, a family of formulas may be necessary, with provision for the usage of Contractor's equipment in the works formula.

Appendix 3. Insurance Requirements

Insurances To Be Taken Out By The Contractor

In accordance with the provisions of GCC Clause 49, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

The minimum insurance cover shall be 110% (Hundred Ten). The insurance policy would be furnished from Bangladesh Sadharan Bima Corporation.

The Contractor/Supplier shall secure and maintain throughout the duration of the contract insurance of such types and in such amounts as may be necessary to protect himself and the interest of Purchaser against hazards of risk or loss at Supplier's cost. Failure of the Supplier to maintain such coverage shall not relieve him of any contractual responsibility or obligations for transportation and ocean cargo insurance from port of loading to port of unloading and from warehouse to warehouse in Bangladesh.

As Marine/Cargo insurance as well as Local Insurance shall be from Sadharan Bima Corporation, 139, Motijheel Commercial Area, Dhaka, Bangladesh and the cost shall be paid by Supplier/Contractor. Shipment of goods in any chartered vessel over 15(fifteen) years of age and shipment of goods in the Deck are prohibited.

(a) Cargo Insurance

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefore) and to the construction equipment to be provided by the Contractor or its Subcontractors.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]
Hundred Ten Percent (110%) of Contract Price	-----	NESCO	Supplier's or manufacturer's Works or Stores	Contractor's Store in Bangladesh

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the Site for the purpose of performing its obligations during the defect liability period.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]
Hundred Ten Percent (110%) of Contract Price	-	NESCO		

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property (including the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the Facilities.

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]
In accordance statutory requirement				

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors (whether or not owned by them) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurances

The Contractor is also required to take out and maintain at its own cost the following insurances:

Details:

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]
Nil	Nil	Nil	Nil	Nil

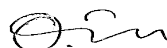
The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Third-Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 49.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Insurances to be Taken Out By The Employer

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances.

Details:

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]
Nil	Nil	Nil	Nil	Nil





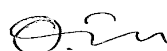
Insurances to be Taken Out By The Employer

If the Employer is proposing to take out any or all of the above insurances itself, or any other insurances in respect of the Facilities, either in its own name or in the joint names of itself and the Contractor, it shall give details below prior to issuing the tender documents. Under the terms of the Contract, the Contractor and the Contractor's Subcontractors shall be named as co-insured under all such policies.

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances.

Details:

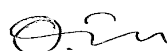
Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]



Appendix 4. Time Schedule

Except under exceptional circumstances, the Time Schedule should indicate periods of time (e.g., weeks or months) and not specify calendar dates. All periods should be shown from the Signing Date of the Contract.

The Tenderer shall be required to submit with its tender a detailed program, normally in the form of a bar chart & CPM, showing how and the order in which it intends to perform the Contract and showing the key events requiring action or decision by the Employer. In preparing this Program, the Tenderer shall adhere to the Time(s) for Completion given in the Bid Data Sheet or give its reasons for not adhering thereto. The Time Schedule submitted by the selected Tenderer and amended as necessary prior to award of Contract shall be included as Appendix to the Contract Agreement before the Contract is signed.



Appendix 5. List of Major Items of Plant and Services and List of Approved Subcontractors-None

Prior to issuing the Tender Document, the Employer has established a list of major item of plant and services for which approval of the Employer is required. Prior to award of Contract, the details of approved subcontractor, including manufacturers shall be completed, indicating those subcontractors proposed by the Tenderer in the corresponding Attachment to its tender that are approved by the Employer for engagement by the Contractor during the performance of the Contract.

A list of major items of plant and services is provided below.

The following Subcontractors and/or manufacturers are approved for carrying out the item of the facilities indicated. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with GCC Sub-Clause 32.1, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Employer and their names have been added to this list of Approved Subcontractors.

Major Items of Plant and Services	Approved Subcontractors/Manufacturers	Nationality

Appendix 6. Scope of Works and Supply by the Employer: As Per Section 6,7,8,9

Prior to issuing the tender documents, the Employer shall indicate in this Appendix details of all personnel and Facilities it will provide for use by the Contractor and indicate, where applicable, the charges that it will make in respect of their use.

The Employer shall also identify any part(s) of the facilities it intends to carry out itself (or by other contractors), and any plant, equipment, or materials that it proposes to purchase itself and supply to the Contractor for incorporation in the facilities, indicating, where applicable, the charges that it will make in respect thereof.

The following personnel, facilities, works and supplies shall apply as appropriate.

All personnel, facilities, works and supplies will be provided by the Employer in good time so as not to delay the performance of the Contractor, in accordance with the approved Time Schedule and Program of Performance pursuant to GCC Sub-Clause 31.2.

Unless otherwise indicated, all personnel, facilities, works and supplies will be provided free of charge to the Contractor.

Personnel	Charge to Contractor (if any)
The Employer will provide operating and maintenance personnel under the Contractor's supervision to get them (employer's O & M personnel) acquainted with and to witness the commissioning of the plant & machineries.	No charge to Contractor.

Facilities	Charge to Contractor (if any)

Works	Charge to Contractor (if any)
Employer will not do any works. If Contractor do not re-instate the Employer's existing facilities (Civil, fencing etc.) Employer will complete it.	Will be deducted from contractor's payment.

Supplies	Charge to Contractor (if any)
The Employer will not generally supply any machinery/Equipment and materials to the Contractor for the Substation. In the event of any such requirement and subject to availability, the Employer may extend the facilities to use such machinery and materials by the Contractor on rental charge/cost under normal terms and conditions.	The Contractor will be required to pay the amount to be determined by the Employer for such facilities required for the Substation.

Appendix 7. List of Documents for Approval or Review

Pursuant to GCC Sub-Clause 35.3.1, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Project Manager in accordance with the requirements of GCC Sub-Clause 31.2 (Program of Performance), the following documents for

(A) Approval

1. Single Line Diagram of the Bay
2. Site Layout Plan and arrangement drawings of the Bay.
3. Proposed lay-down area for construction purpose.
4. Detailed soil investigation program where required, soil test report if required.
5. Civil (Building and others) Drawing.
6. All drawings and design as per Section 5, 6, 7 (architectural, foundation and superstructure)
7. Installation drawings, lay out, grounding/earthing design, Lightning protection, lay out of fire protection etc.
8. All detail Specification, GTP, General Arrangement, Electrical, Mechanical, Dimensional, Cross-Sectional, Connection Drawing for equipment described in Price Schedule.
9. As Built Drawings.
10. Others as required.
11. Every drawing must be provided in hardcopy, softcopy, and AutoCAD softcopy format.
12. Design, drawing diagrams, Specifications, Technical Details, Guarantees, etc., accompanied by Outline, Dimensional, Cross-sectional, and General arrangement drawings, as well as Installation diagrams and printed catalogs detailing the characteristics of each offered equipment, these materials should be delivered to the Employer for approval of the Superintending Engineer, Design & Inspection Department of NESCO. Prior to commencing production, the Design & Inspection Department of NESCO, must grant approval for the submitted Design, drawing diagrams, Specifications, Technical Particulars, and Guarantees."
13. The Bidder shall have to submit 3 (three) sets of the same for Approval within 15 days from the date of signing Contract. The bidder shall also submit one set reproducible tracing of the above drawings in soft format.

(B) Review

1. Listing of additional equipment requirements to match design.



Appendix 8. Functional Guarantees: Not Applicable

1. General

This Appendix sets out

- (a) the functional guarantees referred to in GCC Clause 43 (Functional Guarantees)
- (b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below
- (c) the minimum level of the functional guarantees
- (d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

2. Preconditions

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied: *[List any conditions for the carrying out of the Guarantee Test referred to in GCC Sub-Clause 40.2.]*

3. Functional Guarantees

Subject to compliance with the foregoing preconditions, the Contractor guarantees as follows:

- 3.1 Production Capacity** *[List here the production capacity that the Contractor is to guarantee, making sure to use, as functional guarantees, the figures offered by the Contractor in its tender]*
- 3.2 Raw Materials and Utilities Consumption** *[List here the guaranteed items of consumption per unit of production (e.g., kg, tons, kcal, kWh, etc.) that the Contractor is to guarantee, making sure to use, as functional guarantees, the figures offered by the Contractor in its tender]*

4. Failure in Guarantees and Liquidated Damages

4.1 Failure to Attain Guaranteed Production Capacity

If the production capacity of the facilities attained in the guarantee test, pursuant to GCC Sub-Clause 40.2, is less than the guaranteed figure specified in para. 3.1 above, but the actual production capacity attained in the guarantee test is not less than the minimum level specified in para. 4.3 below, and the Contractor elects to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities, pursuant to GCC Sub-Clause 43.3, then the Contractor shall pay liquidated damages at the rate of *[amount in the contract currency]* for every complete one percent (1%) of the deficiency in the production capacity of the Facilities, or at a proportionately reduced rate for any deficiency, or part thereof, of less than a complete one percent (1%).

4.2 Raw Materials and Utilities Consumption in Excess of Guaranteed Level

[To be specified in the appropriate wording for the type of facilities if there are consumption guarantee]

If the actual measured figure of specified raw materials and utilities consumed per unit (or their average total cost of consumption) exceeds the guaranteed figure specified in para. 3.2 above (or their specified average total cost of consumption), but the actual

consumption attained in the guarantee test, pursuant to GCC Sub-Clause 25.2, is not more than the maximum level specified in para. 4.3 below, and the Contractor elects to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities pursuant to GCC Sub-Clause 43.3, then the Contractor shall pay liquidated damages at the rate of *[amount in the contract currency]* for every complete one percent (1%) of the excess consumption of the Facilities, or part thereof, of less than a complete one percent (1%).

[The rate of liquidated damages specified in paras. 4.1 and 4.2 above shall be at least equivalent to the rate specified in Section 3 (General Conditions of Contract) for the comparison of functional guarantees provided by the Tenderers]

4.3 Minimum Levels

Notwithstanding the provisions of this paragraph, if as a result of the guarantee test(s), the following minimum levels of performance guarantees (and consumption guarantees) are not attained by the Contractor, the Contractor shall at its own cost make good any deficiencies until the Facilities reach any of such minimum performance levels, pursuant to GCC Sub-Clause 43.2:

- (a) production capacity of the Facilities attained in the guarantee test: ninety-five percent (95%) of the guaranteed production capacity

and/or

- (b) average total cost of consumption of all the raw materials and utilities of the Facilities: one hundred and five percent (105%) of the guaranteed figures.

4.4 Limitation of Liability

Subject to para. 4.3 above, the Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantees shall not exceed *[the percentage specified shall not exceed ten percent (10%)]*. percent (. . . %) of the Contract price

Section 5. Tender and Contract Forms

Form	Title
Tender Forms	
PG5A – 1a	Tender Submission Letter for Technical Proposal
PG5A – 1b	Tender Submission Letter for Financial (Price) Proposal
PG5A – 2a	Tenderer Information Sheet
PG5A – 2b	JVCA Partner Information
PG5A – 2c	Subcontractor Information
PG5A – 3	Price Schedule for Plant and Services
PG5A – 4	Technical Proposal
PG5A – 4a	Specification submission & compliance sheet.
PG5A– 5	Manufacturer’s Authorisation Letter
PG5A – 6	Bank Guarantee for Tender Security
PG5A – 6a	Letter of Commitment for Bank’s undertaking for Line of Credit (Form PG5A-6a)
Contract Forms	
PG5A – 7	Notification of Award
PG5A – 8	Contract Agreement
PG5A – 9	Bank Guarantee for Performance Security
PG5A– 10	Bank Guarantee for Advance Payment
PG5A– 11	Bank Guarantee for Retention Money Security (Form PG5A-11)

Forms PG5A-1a, PG5A-1b to PG5A-6, PG5A-6a comprises part of the Tender and should be completed as stated in ITT Clause 24.

Forms PG5A-7 to PG5A-11 and the appendices of the tender comprises part of the Contract as stated in GCC Clause 6.

Tender Submission Letter for Technical offer (Form PG5A-1a)

[This letter should be completed and signed by the Authorised Signatory preferably on the Letter-Head Pad of the Tenderer and be appended in the technical proposal envelope]

To:

Date:

[Contact Person]

[Name of Procuring Entity]

[Address of Procuring Entity]

Invitation for Tender No:

[indicate IFT No]

Tender Package No:

[indicate Package No]

This Package is divided into the following Number of Lots

[indicate number of Lot(s)]

We, the undersigned, offer to design, manufacture, test, deliver, install, pre-commission and commission in conformity with the Tender Document, the following Plant and Services, viz:

In signing this letter, and in submitting our Tender, we also confirm that:

- (a) our Tender shall be valid for the period stated in the Tender Data Sheet (ITT Sub Clause 30.1) and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (b) a Tender Security is attached in the form of a *[state pay order, bank draft, bank guarantee]* in the amount stated in the Tender Data Sheet (ITT Sub Clause 32) and valid for a period of twenty eight (28) days beyond the Tender validity date;
- (c) we have examined and have no reservations to the Tender Document, issued by you on *[insert date]*; including Addendum to Tender Document No(s) *[state numbers]* , issued in accordance with the Instructions to Tenderers (ITT Clause 11). *[insert the number and issuing date of each addendum; or delete this sentence if no Addendum has been issued]*;
- (d) we, including as applicable, any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub Clause 5.1;
- (e) we are submitting this Tender as a sole Tenderer in accordance with ITT Sub Clause 38.3
or
we are submitting this Tender as the partners of a JVCA, comprising the following other partners in accordance with ITT Sub Clause 18.1;

	Name of Partner	Address of Partner
1		
2		
3		
4		

- (f) *we are not a Government owned entity as defined in ITT Sub Clause 5.3 or
we are a Government owned entity, and we meet the requirements of ITT Sub Clause 5.3;*

(delete one of the above as appropriate)

- (g) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents in accordance with ITT Sub Clause 5.5;
- (h) we, including as applicable any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices in accordance with ITT Sub Clause 5.6;
- (i) furthermore, we are aware of ITT Clause 4 concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;
- (j) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub Clause 19.1, to the following Subcontractor(s);

Activity or part of the Plant and Services	Name of Subcontractor with Address

- (k) we, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the works, not properly completing contracts, inordinate delays, or financial failure as stated in ITT Clause 5.7, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information (**Form PG5A-2b**);
- (l) we are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall constitute the acceptance of our Tender and shall become a binding Contract between us, until a formal Contract is prepared and executed;
- (m) we, including as applicable any JVCA partner, confirm that we do not have a record of insolvency, receivership, bankrupt or being wound up, our business activities were not been suspended, and it was not been the subject of legal proceedings in accordance with ITT Sub Clause 5.8;
- (n) we, including as applicable any JVCA partner, confirm that we have fulfilled our obligations to pay taxes and social security contributions applicable under the relevant national laws and regulations of Bangladesh in accordance with ITT Sub Clause 5.9;
- (o) we understand that you reserve the right to reject all the Tenders or annul the Tender proceedings, without incurring any liability to Tenderers, in accordance with ITT Clause 59.

Signature:	<i>[insert signature of authorised representative of the Tenderer]</i>
Name:	<i>[insert full name of signatory with National ID Number, if applicable]</i>
In the capacity of:	<i>[insert capacity of signatory]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer	

[If there is more than one (1) signatory, or in the case of a JVCA, add other boxes and sign accordingly]. **Attachment 1:**

[ITT Sub Clause 38.3]

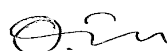
Written confirmation authorising the above signatory(ies) to commit the Tenderer

[and, if applicable]

Attachment 2:

[ITT Sub Clause 29.2(b)]

Copy of the JVCA Agreement / Letter of Intent to form JVCA with draft proposed Agreement



Tender Submission Letter for Financial offer (Form PG5A-1b)

[This letter should be completed and signed by the Authorised Signatory preferably on the Letter-Head Pad of the Tenderer and be appended in the financial proposal envelope]

To:

Date:

[Contact Person]

[Name of Procuring Entity]

[Address of Procuring Entity]

Invitation for Tender No:

[indicate IFT No]

Tender Package No:

[indicate Package No]

This Package is divided into the following Number of Lots

[indicate number of Lot(s)]

We, the undersigned, offer to design, manufacture, test, deliver, install, precommission and commission in conformity with the Tender Document, the following Plant and Services, viz:

In accordance with ITT Clauses 26 and 27, the following prices and discounts apply to our Tender:

The Tender Price is: (ITT Sub-Clause 26.1)	<i>[state amount in figures] and [state amount in words]</i>
Plant (including Mandatory Spare Parts) Supplied from abroad	<i>[state amount in figures] and [state amount in words]</i>
Plant (including Mandatory Spare Parts) supplied from within the Employer's Country	<i>Taka [state amount in figures] And Taka [state amount in words]</i>
Design Services	<i>[state amount in figures] and [state amount in words]</i>
Installation and Other Services	<i>[state amount in figures] and [state amount in words]</i>
Recommended Spare parts Price (If economic Factor is applicable)	<i>[state amount in figures] and [state amount in words]</i>
The Unconditional discount is (ITT Sub-Clause 23.11)	<i>[state amount in figures] and [state amount in words]</i>
The methodology for Application of the discount is:	<i>[state the methodology]</i>

and we shall accordingly submit an Advance Payment Guarantee in the format shown in Form PG5A- 10.

In signing this letter, and in submitting our Tender, we also confirm that:

- a) our Tender shall be valid for the period stated in the Tender Data Sheet (ITT Sub Clause 30.1) and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

- b) a Tender Security is attached in the form of a [state pay order, bank draft, bank guarantee] in the amount stated in the Tender Data Sheet (ITT Sub Clause 32) and valid for a period of twenty eight (28) days beyond the Tender validity date;
- c) if our Tender is accepted, we commit to furnishing a Performance Security within the time stated under ITT Sub Clause 65.1) and in the form specified in the Tender Data Sheet (ITT Sub Clause 66.1) valid for a period of twenty eight (28) days beyond the date of issue of the Completion Certificate of the Plants and Services;
- d) we have examined and have no reservations to the Tender Document, issued by you on [insert date]; including Addendum to Tender Document No(s) [state numbers] , issued in accordance with the Instructions to Tenderers (ITT Clause 11). [insert the number and issuing date of each addendum; or delete this sentence if no Addendum has been issued];
- e) we, including as applicable, any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have nationalities from eligible countries, in accordance with ITT Sub Clause 5.1;
- f) we are submitting this Tender as a sole Tenderer in accordance with ITT Sub Clause 38.3 or we are submitting this Tender as the partners of a JVCA, comprising the following other partners in accordance with ITT Sub Clause 18.1;

	Name of Partner	Address of Partner
1		
2		
3		
4		

- g) we are not a Government owned entity as defined in ITT Sub Clause 5.3 or
we are a Government owned entity, and we meet the requirements of ITT Sub Clause 5.3;
(delete one of the above as appropriate)
- h) we, including as applicable any JVCA partner, declare that we are not associated, nor have been associated in the past, directly or indirectly, with a consultant or any other entity that has prepared the design, specifications and other documents in accordance with ITT Sub Clause 5.5;
- i) we, including as applicable any JVCA partner or Subcontractor for any part of the contract resulting from this Tender process, have not been declared ineligible by the Government of Bangladesh on charges of engaging in corrupt, fraudulent, collusive or coercive practices in accordance with ITT Sub Clause 5.6;
- j) furthermore, we are aware of ITT Clause 4 concerning such practices and pledge not to indulge in such practices in competing for or in executing the Contract;
- k) we intend to subcontract an activity or part of the Works, in accordance with ITT Sub Clause 19.1, to the following Subcontractor(s);

Activity or part of the Plant and Services	Name of Subcontractor with Address

- l) we, including as applicable any JVCA partner, confirm that we do not have a record of poor performance, such as abandoning the works, not properly completing contracts, inordinate

delays, or financial failure as stated in ITT Clause 5.7, and that we do not have, or have had, any litigation against us, other than that stated in the Tenderer Information **(Form PG5A-2b)**;

- m) we are not participating as Tenderers in more than one Tender in this Tendering process. We understand that your written Notification of Award shall constitute the acceptance of our Tender and shall become a binding Contract between us, until a formal Contract is prepared and executed;
- n) we, including as applicable any JVCA partner, confirm that we do not have a record of insolvency, receivership, bankrupt or being wound up, our business activities were not been suspended, and it was not been the subject of legal proceedings in accordance with ITT Sub Clause 5.8;
- o) we, including as applicable any JVCA partner, confirm that we have fulfilled our obligations to pay taxes and social security contributions applicable under the relevant national laws and regulations of Bangladesh in accordance with ITT Sub Clause 5.9;
- p) we understand that you reserve the right to reject all the Tenders or annul the Tender proceedings, without incurring any liability to Tenderers, in accordance with ITT Clause 61

Signature:	<i>[insert signature of authorised representative of the Tenderer]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
In the capacity of:	<i>[insert capacity of signatory]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer	

[If there is more than one (1) signatory, or in the case of a JVCA, add other boxes and sign accordingly]. **Attachment 1:**

[ITT Sub Clause 38.3]

Written confirmation authorising the above signatory(ies) to commit the Tenderer

[and, if applicable]

Attachment 2:

[ITT Sub Clause 29.2(b)]

Copy of the JVCA Agreement / Letter of Intent to form JVCA with draft proposed Agreement

Tenderer Information (Form PG5A-2a)

[This Form should be completed only by the Tenderer, preferably on its Letter-Head Pad]

Invitation for Tender No:

[indicate IFT No]

Tender Package No:

[indicate Package No]

This Package is divided into the following Number of Lots:

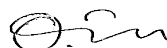
[indicate number of Lot(s)]

1. Eligibility Information of the Tenderer [ITT –Clauses 5 & 29]				
1.1	Nationality of individual or country of registration			
1.2	Tenderer's legal title			
1.3	Tenderer's registered address			
1.4	Tenderer's legal status <i>[complete the relevant box]</i>			
	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			
	<u>A. Arbitration Awards made against</u>			
	Ar	Matter in dispute	Value of Award	Value of Claim
	<u>B. Arbitration Awards pending</u>			

	Year	Matter in dispute		Value of Claim
1.8	Tenderer to attach photocopies of the original documents mentioned aside		[All documents required under ITT Clauses 5 and 29]	
The following two information are applicable for National Tenderers				
1.9	Tenderer's Value Added Tax Registration (VAT) Number			
1.10	Tenderer's Tax Identification Number(TIN)			
[The foreign Tenderers, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]				
2. Qualification Information of the Tenderer [ITT Clause 29]				
2.1 General Experience in Plant and Services of Tenderer				
	Start Month Year	End Month Year	Years	Contract No and Name of Contract Name and Address of Procuring Entity Brief description of Plant and Services
				Role of Tenderer [Contractor/Subcontractor /Management Contractor]
2.2	Specific Experience in Key Activities			
	Contract No Name of Contract		[insert reference no] of [insert year] [insert name]	
	Role in Contract [tick relevant box].		Contractor	Subcontractor Management Contractor
	Award date Completion date Total Contract Value		[insert date] [insert date] [insert amount]	
	Procuring Entity's Name Address Tel / Fax <u>e-mail</u> Brief description with justifications of the similarity compared to the Procuring Entity's requirements		[state justification in support of its similarity compared to the proposed works]	

2.3	Average annual turnover [ITT Sub Clause 15.1(a)] <i>[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]</i>		
	Year	Amount & Currency	amount in figures
2.4	Financial Resources available to meet the cash flow [ITT Sub Clause 15.1(b)]		
	No	Source of Financing	Amount Available
In order to confirm the above statements the Tenderer shall submit , as applicable, the documents mentioned in ITT Sub Clause 14.1(a), (b) and 15.1 (a), (b) & (c)			
2.5	Contact Details		
	Name, address, and other contact details of Tenderer Bankers and other Procuring Entity(s) that may provide references, if contacted by this Procuring Entity		
2.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 16.1]		
	Position Name Years of General Experience	Years of Specific Experience	
<i>[Tenderer to complete details of as many personnel as are applicable. Each personnel listed above should complete the Personnel Information (Form PG5A-5)]</i>			
2.7	Major Equipment proposed to carry out the Contract [ITT Sub Clause 17.1]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, less or seller)

<i>[Tenderer to list details of each item of major equipment, as applicable]</i>			
Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>	
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>	
Duly authorised to sign the Tender for and on behalf of the Tenderer			


JVCA Partner Information (Form PG5A-2b)

[This Form should be completed by each JVCA partner].

Invitation for Tender No:

[indicate IFT No]

Tender Package No

[indicate Package No]

This Package is divided into the following Number of Lots

[indicate number of Lot(s)]

1. Eligibility Information of the JVCA Partner [ITT –Clauses 5 & 29]			
1.1	Nationality of Individual or country of Registration		
1.2	JVCA Partner's legal title		
1.3	JVCA Partner's registered address		
1.4	JVCA Partner's legal status [complete the relevant box]		
	Proprietorship		
	Partnership		
	Limited Liability Concern		
	Government-owned Enterprise		
	Other (please describe, if applicable)		
1.5	JVCA Partner's year of registration		
1.6	JVCA Partner's authorised representative details		
	Name		
	National ID number		
	Address		
	Telephone / Fax numbers		
	e-mail address		
1.7	Litigation [ITT Sub Cause 13]		
	If there is no history of litigation or no pending litigation then state "None". If there is a history of litigation, or a number of awards, against the JVCA Partner provide details below:		
	<u>A. Arbitration Awards made against</u>		
	Year	Matter in dispute	Value of Award
	<u>B. Arbitration Awards pending</u>		
	Year	Matter in dispute	Value of Claim

1.8	JVCA Partner to attach copies of the original documents mentioned aside			[All documents required under ITT Clauses 5 and 29]	
The following two information are applicable for national JVCA Partners only					
1.9	JVCA Partner's Value Added Tax Registration (VAT) Number				
1.10	JVCA Partner's Tax Identification Number (TIN)				
[The foreign JVCA Partners, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]					
2. Key Activity(ies) for which it is intended to be joint ventured [ITT Sub Clause 18.2 & 18.3]					
	Elements of Activity			Brief description of Activity	
3. Qualification Information of the JVCA Partner [ITT Clause 18]					
3.1	General Experience in Plant and Services of JVCA Partner				
	Start Month Year	End Month Year	Years	Contract No and & Name of Contract Name and Address of Procuring Entity Brief description of Works	Role of JVCA Partner [Contractor/Subcontractor/Management Contractor]
3.2	Specific Experience in Key Activities				
	Contract No Name of Contract		[insert reference no] of [insert year] [insert name]		
	Role in Contract [tick relevant box]		Contractor	Sub contractor	Management Contractor
	Award date Completion date Total Contract Amount		[insert date] [insert date] [insert amount]		
	Procuring Entity's Name Address Tel / Fax <u>e-mail</u>		[state justification in support of its similarity compared to the proposed plants and service] Brief description with justifications of the similarity compared to the Procuring Entity's requirements		

3.3	Average annual construction turnover [ITT Sub Clause 15.1 (a)] <i>[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]</i>		
	Year	Amount & Currency	Amount in Figures
3.4	Financial Resources available to meet the cash flow [ITT Sub-Clause 15.1(b)]		
		Source of financing	Amount available
	In order to confirm the above statements the JVCA Partner shall submit , as applicable, the documents mentioned in ITT Sub Clause 14.1 (a) & (b) 15.1 (a), (b), (c) & (d)		
3.5	Contact Details		
	Name, address, and contact details of Tenderer's Bankers and other Procuring Entity(s) that may provide references if contacted by this Procuring Entity		
3.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 16.1]		
	Position Name Years of General Experience	Years of Specific Experience	
	<i>[Tenderer to complete details of as many personnel as are applicable. Each personnel listed above should complete the Personnel Information (Form PG5A-5)]</i>		
3.7	Major items of Construction Equipment proposed for carrying out the works [ITT Sub-Clause 17.1]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, leaser or seller)
<i>[Tenderer to list details of each item of Major equipment, as applicable]</i>			

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>

In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer		





Subcontractor Information (Form PG5A-2c)

[This Form should be completed by each Subcontractor, preferably on its Letter-Head Pad]

Invitation for Tender No:

[indicate IFT No]

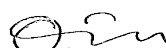
Tender Package No

[indicate Package No]

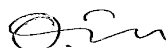
This Package is divided into the following Number of Lots

[indicate number of Lot(s)]

1. Eligibility Information of the Subcontractor [ITT –Clauses 5 & 29]		
1.1	Nationality of Individual or country of Registration	
1.2	Subcontractor's legal title	
1.3	Subcontractor's registered address	
1.4	Subcontractor's legal status <i>[complete the relevant box]</i>	
	Proprietorship	
	Partnership	
	Limited Liability Concern	
	Government-owned Enterprise	
	Other (please describe)	
1.5	Subcontractor's year of registration	
1.6	Subcontractor's authorised representative details	
	Name	
	Address	
	Telephone / Fax numbers	
	e-mail address	
1.7	Subcontractor to attach copies of the following original documents	All documents to the extent relevant to ITT Clause 5 and 29 in support of its qualifications
The following two information are applicable for national Subcontractors		
1.8	Subcontractor's Value Added Tax Registration (VAT) Number	
1.9	Subcontractor's Tax Identification Number(TIN)	
[The foreign Subcontractors , in accordance with ITT sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]		
2. Key Activity(ies) for which it is intended to be Subcontracted [ITT Sub Clause 19.1]		
2.1	Elements of Activity	Brief description of Activity


2.2	List of Similar Contracts in which the proposed Subcontractor had been engaged	
	Name of Contract and Year of Execution	
	Value of Contract	
	Name of Procuring Entity	
	Contact Person and contact details	
	Type of Assignment performed	
Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer		


Price Schedule for Plant and Service (Form PG5A-3)

(This form should be completed and submitted by the tenderer and appended in the financial proposal envelope)

Invitation for Tender No:	<i>[indicate IFT No]</i>
Tender Package No	<i>[indicate Package No]</i>
This Package is divided into the following Number of Lots	<i>[indicate number of Lot(s)]</i>

General

- The Price Schedules are divided into separate Schedules as follows:
Schedule No. 1: Not Applicable
Schedule No. 2: Plant and Mandatory Spare Parts Supplied
Schedule No. 3: Design Services
Schedule No. 4: Civil works
Schedule No. 5: Installation and Other Services
Schedule No. 6: Grand Summary
Schedule No. 7: Recommended Spare Parts
- The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Tenderers shall be deemed to have read the Employer's Requirements and other sections of the Tender Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.
- If tenderers are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITT 9.1 prior to submitting their tender.

Pricing

- Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Tenderer.
As specified in the Tender Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.
- Tender prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Tenderers in the Tender Document.
For each item, tenderers shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.
Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements) or elsewhere in the Tender Document.
- Payments will be made to the Contractor in the currency or currencies indicated under each respective item.
- When requested by the Employer for the purposes of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Schedules of Rates and Prices

Schedule No. 1 – Not Applicable

Schedule No. 2 - Plant and Mandatory Spare Parts Supplied

Line Item No	Description of Item	Country of Origin	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7=5x6</u>
1	Supply Of 36 KV 1600A, 31.5 KA For 3 Sec Outdoor Type VCB along with accessories (As Per Scope of Works, Technical Specification And GTP).		Set	4		
2	Supply Of 33 KV Protection, Control Metering Panel For 33 KV Line Feeder with Numerical Relay (Directional O/C + Directional E/F & Non-Directional O/C + E/F). All The Circuit Breaker's Control with Local/ Remote Switch, Metering and Status Data shall have provision for Interfacing with Substation Automation System & SCADA System. (As Per Scope of Works, Technical Specification, GTP & SLD).		Set	4		
3	Supply Of 33 KV, Single Phase Lightning Arrestor (Polymer Insulation-ZnO-Type) including Surge Monitor/Counter along with supporting structure and along with accessories (As Per Scope of Works, Technical Specification And GTP)		Set (1 set= 3 nos.)	4		
4	Supply of 33 KV Isolator (1600A, 31.5 KA for 3 sec) without earthing blade gang operated vertical break with supporting steel structure with necessary connections and accessories for outgoing feeders at Bus side (As per scope of works, Technical Specification and GTP).		Set	4		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

137 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

Line Item No	Description of Item	Country of Origin	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7=5x6</u>
5	Supply Of 33 KV Isolator (1600A, 31.5 KA For 3 Sec) With Earthing Blade Gang Operated (02 nos Horizontal mounting, Horizontal Break & 02 nos vertical mounting, vertical break) with Supporting Steel Structure with Necessary Connections and Accessories (As Per Scope of Works, Technical Specification And GTP)		Set	4		
6	Supply Of 33 KV Bus Section Isolator (2500A, 31.5 KA For 3 Sec) Without Earthing Blade Gang Operated Horizontal Structure for Installation on Gantry Steel Structure with Necessary Connections and Accessories (As Per Scope of Works, Technical Specification And GTP).		Set	1		
7	Supply of 33 KV off load fused Isolator (400A) along with fuse and supporting steel structure with necessary connections and accessories for 33 KV PT & Auxiliary transformers (As per scope of works, Technical Specification and GTP)		Set	1		
8	Supply Of 33 KV Single Phase Current Transformer 600-1200/5-5-5A (Core-1: Indicating Meter on PCM Panel, Core-2: Energy Meter, Core-3: Protection) Class 5P30, 30VA And 0.2S Along with Supporting Structure and Suitable Bi-Metallic Connectors and With Accessories for Line Feeder (As Per Scope of Works, Technical Specification And GTP)		Set (1 set= 3 nos.)	4		
9	Supply Of 33 KV Single Phase Potential Transformer (Ratio 33/ $\sqrt{3}$ /.11/ $\sqrt{3}$ /.11/ $\sqrt{3}$ KV) Class 0.2, 50VA And 3P Along with Supporting Structure and Suitable Bi-Metallic Connectors and		Set (1 set= 3 nos.)	1		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

Line Item No	Description of Item	Country of Origin	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7=5x6</u>
	With Accessories (As Per Scope of Works, Technical Specification And GTP)					
10	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary for Grounding LA, VCB, CT, Gantry Structure etc and MCCB, connectors to connect different panels/auxiliary transformer etc. 4Cx4mm ² , 4Cx6mm ² , 4Cx2.5mm ² , 8Cx2.5mm ² , 14Cx 2.5mm ² , 16Cx 2.5mm ² , 19Cx 2.5mm ² , 24Cx2.5 mm ² etc including all accessories. (As per Scope of Plant & Services, Technical Specification and GTP).		Lot	1		
11	33 KV Cable termination kit (Outdoor 1Cx500 sq.mm XLPE (Cu) Power Cable) along with all requirements for connection for Outgoing feeder.		Set	12		
12	Cu Bus bar for connecting outgoing side of 33KV Horizontal Line Isolator to XLPE Cu Cable. Following facts should be considered- Cross section of Copper Bus bar shall be of minimum size (1000 mm ²) (As per Scope of Plant & Services, Technical Specification and GTP).		Lot	1		
13	Supply Of Substation Hot Dip Galvanized Steel Structure Material For 4D Each 5M X 5M Along with Suitable Beam For 33 KV Bus Section and All Other Necessary Accessories for Installation of Equipment (As Per Scope of Works, Technical Specification And GTP)		1 D (5mx5m)	4		
14	Supply Of Supporting Steel Column Structure For 33KV VCB, CT, LA, Post Insulator Structure (For 2 Bay within 4), Vertical		Lot	1		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

139 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

Line Item No	Description of Item	Country of Origin	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7=5x6</u>
	Isolator & Connecting The 33 KV Power cable with the necessary Connecting Clamps, Insulators as Required for 4 Bay (As Per Scope of Works, Technical Specification And GTP)					
15	33 KV Disk Insulator set with Necessary Suitable Front and Back Connecting Clamps (As Per Scope of Works, Technical Specification And GTP)		Lot	1		
16	Supply 33 KV Bus Bar Conductor ACSR MARTIN (Twin), Bus Capacity - 3000A (As Per Scope of Works, Technical Specification And GTP)		Lot	1		
17	Suitable Busbar Droppers (ACSR MARTIN-Single Loop), Conductors, High Grade AL alloy Connectors and Outdoor Marshaling Kiosk, Necessary Hardware for All Suitable Connections to Each Substation Equipment, Clamps, Nut-Bolts etc. (As Per Scope of Works, Technical Specification And GTP)		Lot	1		
18	Supply Of Shield Wire Overall Diameter Of 9.525 Mm Standard Steel (As Per Scope of Works, Technical Specification And GTP)		Lot	1		
19	Supply Of Terminal Tension Clamp with Fittings and PG Clamps Set for Fixing the Shield Wire with The Gantry Steel Structure (Tension Clamp, PG Clamp, Supporting Clamp) (As Per Scope of Works, Technical Specification And GTP)		Lot	1		
20	Supply of minimum 150 mm ² grounding bare copper conductor & Grounding rod (Earthing electrode, made of copper) dia 16 mm. Ground Conductor have to be laid surrounding the switch yard area creating a mesh with minimum 0.6m depth. Length of		Lot	1		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

140 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

Line Item No	Description of Item	Country of Origin	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7=5x6</u>
	grounding rod will be finalized during earth resistance calculation. Actual Shape of mesh, electrode length, depth, conductor dia etc will be according to design calculation. Consider short circuit current 40 KA for 1 second and allowable person weight minimum 50 KG and step and touch potential as per IEEE or IEC standard and calculation. Earth resistance of new switchyard must be below 0.35 ohm (during test) and 0.3 ohm (during calculation) at dry season (As per scope of works, Technical Specification, GTP & SLD).					
21	Supply Of Suitable Connectors for Connecting with Individual Item of Substation Equipment Between Substation Equipment and Earthing Mesh (As Per Scope of Works, Technical Specification And GTP)		Lot	1		
22	33KV Circuit Breaker Closing Coil (offered type).		Nos.	2		
23	33KV Circuit Breaker Tripping Coil (offered type)		Nos.	2		
24	33 KV Circuit Breaker Charging Motor (offered type)		Nos.	2		
25	33 KV PCM Panel Master Tripping Relay (offered type)		Nos.	2		
26	33 KV PCM Panel Trip Circuit Supervision Relay (offered type)		Nos.	2		
27	33 KV PCM Panel Annunciator		Nos.	2		
28	33kV Single Phase Lightning Arrestor (Station Class) (offered type)		Set	2		

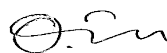
Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

141 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

Line Item No	Description of Item	Country of Origin	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7=5x6</u>
29	33 KV 1CX500 rm Cable Termination Kit (Outdoor Type)		Set	6		
	Column 7 to be carried forward to Schedule No. 6. Grand Summary					

Note: All unit rates and prices quoted by the Tenderers against each basic item or activity shall include the Tenderer's profit, overheads, VAT and all other charges including corresponding incidental service charges and premiums for banking and insurances, as applicable and, shall be the delivered price in final destination or at point of delivery and, thus forth the total Tender Price quoted by the Tenderers.

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer		


Schedule No. 3- Design Services

Item	Description of Item	Unit	Quantity	Unit Price (BDT)	Total Price (BDT)
(1)	(2)	(3)	(4)	(5)	(6)
1	All Design, Drawing and Documentation works including 05 (Five) Sets of As-Built drawings (whole substation & control room), Approved Drawings & GTP and substations operation and maintenance manual (Drawings in AutoCAD format) in a Bound Book (As per Scope of Works, Technical Specification and GTP).	LS	1		
	TOTAL Columns 6 to be carried forward to Schedule No. 6. Grand Summary				

Note: All unit rates and prices quoted by the Tenderers against each basic item or activity shall include the Tenderer's profit, overheads, VAT and all other charges including corresponding incidental service charges and premiums for banking and insurances, as applicable and, shall be the delivered price in final destination or at point of delivery and, thus forth the total Tender Price quoted by the Tenderers.

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

143 4D(5mX5m) Bay extension at Sherpur Grid, Bogura





Schedule No. 4– Civil works part

Item	Description of items	Unit	Quantity	Unit Rate (BDT)	Total Amount (BDT)
1	2	3	4	5	6 = 4*5
1	Earth filling, Land escaping, Leveling, dismantling if required, Dressing / Preparation of Land, Soil Testing (As per scope of works, Technical Specification, GTP & SLD).	Lot	1		
2	Civil works in the existing control room building as required for installation of 33 KV Control Relay Panel.	Lot	1		
3	Supply materials and Construction of Foundation of all Equipment and gantry Structure including CB, CT, LA & PI, DS etc (As per scope of works, Technical Specification, GTP & SLD).	Lot	1		
4	Surface Finishing with gravels for new Sub-station area (As per scope of works, Technical Specification, GTP & SLD).	sq.m	250		
5	Supply materials and construction of approach road (Only for dismantled part of RCC Approach Road for Road Crossing 33KV Power cable trench) & internal road as per site requirements (As per scope of works, Technical Specification, GTP & SLD).	sq.m	10		
6	Supply materials and construction of surface drain (As per scope of works, Technical Specification, GTP & SLD).	Rm	15		
7	Supply materials and construction of RCC Cable Trench with slab & cable rack for power cable laying including RCC Road Crossing Cable trench. (As per scope of works, Technical Specification, GTP & SLD).	Rm	130		
8	Supply materials and construction of RCC Cable Trench with slab & cable rack for Control Cable laying. *** Must be identical with existing cable trench & Slab width, height, thickness in existing 33KV Switch Yard. (As per scope of works, Technical Specification, GTP & SLD).	Rm	30		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.

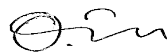
144 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

9	Supply of LED Flood Lights, 240 Volts Single Phase with shade & Fittings and other related accessories (As per scope of works, Technical Specification, GTP & SLD).	Set	8		
	TOTAL Columns 6 to be carried forward to Schedule No. 6. Grand Summary				

Note: All unit rates and prices quoted by the Tenderers against each basic item or activity shall include the Tenderer's profit, overheads, VAT and all other charges including corresponding incidental service charges and premiums for banking and insurances, as applicable and, shall be the delivered price in final destination or at point of delivery and, thus forth the total Tender Price quoted by the Tenderers.

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.


145 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

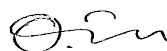
Schedule No. 5- Installation and Other Services

Item	Description	Unit	Quantity	Unit Price	Total Price
1	2	3	4	5	6
1	Addition of new Panel/Bay with Necessary Hardware, Software (If Required) and as Build Drawing in GE SCADA System with complete integration completion of all necessary works as per brief description of works (For all replaced and new bay/feeder seamless GE SCADA integration)	Nos (Bay)	2		
2	Installation, Carrying of all materials, Integration, Inspection, Erection, Testing & Commissioning of the Substation (As per Scope of Works, Technical Specification and GTP).	Lot	1		
TOTAL Columns 6 to be carried forward to Schedule No. 6. Grand Summary					

Note: All unit rates and prices quoted by the Tenderers against each basic item or activity shall include the Tenderer's profit, overheads, VAT and all other charges including corresponding incidental service charges and premiums for banking and insurances, as applicable and, shall be the delivered price in final destination or at point of delivery and, thus forth the total Tender Price quoted by the Tenderers.

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorized to sign the Tender for and on behalf of the Tenderer		

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with on Turnkey Basis.


146 4D(5mX5m) Bay extension at Sherpur Grid, Bogura

Schedule No. 6- Grand Summary

Schedule No.	Title	Total Price
1	Not Applicable	-
2	Plant and Mandatory Spare Parts	
3	Design Service	
4	Civil works	
5	Installation and Other Services	
GRAND TOTAL to be carried forward to Form PG5A-1b		

Note: 1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies

2. Create additional columns for up to a maximum of 3 Foreign Currencies if so required

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Schedule No. 7 - Recommended Spare Parts

Item	Description	Qty	Unit Price	Total Price
1	2	3	4	5

Note: 1. Specify currencies in accordance with ITT 27. Create and use as many columns for Unit Price and Total Price as there are currencies

Name:	<i>[insert full name of signatory]</i>	<i>Signature with Date and Seal</i>
In the capacity of:	<i>[insert designation of signatory]</i>	<i>[Sign]</i>
Duly authorized to sign the Tender for and on behalf of the Tenderer		

Technical Proposal (Form PG5A-4)

[The Revised Technical Proposal, if any, shall follow the same format and structure]

Site Organization

Method Statement

Mobilization Structure

Construction Structure

Plant

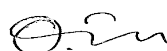
Safety Plan

Personnel

Equipment

Proposed subcontractors for Major Items of Plant and Services

Time Schedule



Site Organization

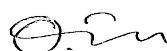
[insert technical proposal for site organization]

[The Tenderer shall include in the tender an appropriate organization chart. This shall include head office as well as site components and clearly demonstrate that the Tenderer possesses the staff and organizational resources to complete the Supply and Installation of Plant & Equipment.]

Method Statement

Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33kV Feeders with 4D(5mX5m) Bay extension at Sherpur Grid, Bogura on Turnkey Basis.

150



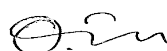
[insert technical proposal for Method Statement]

[The Tenderer shall furnish an overall description covering all activities and processes from inception to site works and commissioning.

In particular methods of minimizing the impact on the environment in accordance with the relevant laws and regulations during the construction phase shall be described.]

Mobilization Schedule

[insert technical proposal for Mobilization Schedule]



[This shall be included in the overall time schedule to be provided by the Tenderer as per “Time Schedule” in Section 5.Tendering Forms



Construction Schedule

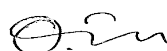
[insert technical proposal for Construction Schedule]

[This shall be included in the overall time schedule to be provided by the Tenderer as per “Time Schedule” in Section 5. Tendering Forms]

Plant

*[insert technical proposal for **Plant**]*

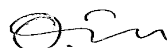
[The Tenderer shall provide the plant and equipment it intends to use in the construction process to demonstrate that it has the capability to complete the Supply and Installation of Plant & Equipment.]



Safety Plan

*[insert technical proposal for **Safety Plan**]*

[The Tenderer shall demonstrate that it has a comprehensive safety system that will be used during the construction and installation phase. This system shall meet all safety requirements in accordance with all relevant laws, rules and regulations.]



Personnel Information

[This Form should be completed for each person proposed by the Tenderer on Form PG5A-2a& PG5A-2b, where applicable]

Invitation for Tender No:	[indicate IFT No]
Tender Package No	[indicate Package No]
This Package is divided into the following Number of Lots	[indicate number of Lot(s)]

A. Proposed Position (tick the relevant box)			
B. Personal Data			
Name			
Date of Birth			
Years overall experience			
Years of specific experience			
National ID Number			
Years of employment with the Tenderer			
B. Professional Qualifications:			
1.			
2.			
C. Present Employment [to be completed only if not employed by the Tenderer]			
Name of Procuring Entity:			
Address of Procuring Entity:			
Present Job Title:			
Years with present Procuring Entity:			
Tel No:	Fax No:	e-mail address:	
Contact [manager/personnel officer]:			
D. Professional Experience			
Summarise professional experience over the last twenty years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.			
	From	To	Company / Project / Position / Relevant technical and management experience.
1			
2			
3			

Name:	[insert full name of signatory]	Signature with Date and Seal
In the capacity of:	[insert designation of signatory]	[Sign]
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Equipment Information

[The Tenderer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in TDS . A Separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Tenderer]

Invitation for Tender No:	[indicate IFT No]
Tender Package No	[indicate Package No]
This Package is divided into the following Number of Lots	[indicate number of Lot(s)]

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Tenderer.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

Name:	[insert full name of signatory]	Signature with Date and Seal
In the capacity of:	[insert designation of signatory]	[Sign]
Duly authorised to sign the Tender for and on behalf of the Tenderer		

Proposed Subcontractors for Major Items of Plant and Installation Services

A list of major items of Plant and Installation Services is provided below.

The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated. Tenderers are free to propose more than one for each item

Major Items of Plant and Installation Services	Proposed Subcontractors/Manufacturers	Nationality

Form Functional Guarantee

The Tenderer shall copy in the left column of the table below, the identification of each functional guarantee required in the Specification and stated by the Employer in ITT 24(n) and in the right column, provide the corresponding value for each functional guarantee of the proposed plant and equipment.

Invitation for Tender No:	<i>[indicate IFT No]</i>
Tender Package No	<i>[indicate Package No]</i>
This Package is divided into the following Number of Lots	<i>[indicate number of lot(s)]</i>

Required Functional Guarantee	Value of Functional Guarantee of the Proposed Plant and Equipment
1.	
2.	
3.	
4.	
5.	
6.	

Specifications Submission and Compliance Sheet (Form PG5A-4a)

Invitation for Tender No:

Tender Package No:

Date:

Package Description: *[enter description as specified in Section 6]*

Tender Lot No:

Lot Description: *[enter description as specified in Section 6]*

Item No.	Name of Goods or Related Service	Country of Origin	Make and Model (<i>when applicable</i>)	Full Technical Specifications and Standards
1	2	3	4	5
	FOR GOODS			Note 1
	FOR RELATED SERVICES			

[The Tenderer should complete all the columns as required]

Signature:	<i>[insert signature of authorised representative of the Tenderer]</i>
Name:	<i>[insert full name of signatory with National ID]</i>
In the capacity of:	<i>[insert designation of signatory]</i>
Duly authorised to sign the Tender for and on behalf of the Tenderer	





Manufacturer's Authorisation Letter (Form PG5A - 5)

*[The Tenderer shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. The Tenderer shall include it in its tender, if so indicated in the **TDS as stated under ITT Sub-Clause 29.1(b)**]*

Invitation for Tender No:	Date:
Tender Package No:	
Tender Lot No:	
To: Name and address of Employer]	

WHEREAS

We *[insert complete name of Manufacturer]*,

who are official manufacturers of *[insert type of goods manufactured]*, having factories at *[insert full address of Manufacturer's factories]*, do hereby

authorize *[insert complete name of Tenderer]* to supply the following Plant and Equipment, manufactured by us *[insert name and or brief description of the Goods]*.

We hereby extend our full guarantee and warranty as stated under GCC Clause 42 of the General Conditions of Contract, with respect to the Goods offered by the above Tenderer.

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

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

Address: *[insert full address including Fax and e-mail]*

Title: *[insert title]*

Date: *[insert date of signing]*



Bank Guarantee for Tender Security (Form PG5A– 6)

[this is the format for the Tender Security to be issued by a scheduled bank of Bangladesh as stated under ITT Clauses 32 and 33]

Invitation for Tender No:

Date:

Tender Package No:

Tender Lot No:

To:

[Name and address of Employer]

TENDER GUARANTEE No:

We have been informed that *[insert name of Tenderer]* (hereinafter called “the Tenderer”) intends to submit to you its Tender dated *[insert date of Tender]* (hereinafter called “the Tender”) for the supply and installation of *[description of plant and services]* under the above Invitation for Tenders (hereinafter called “the IFT”).

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

At the request of the Tenderer, we *[insert name of bank]* hereby irrevocably and unconditionally undertake to pay you, without cavil or argument, any sum or sums not exceeding in total an amount of Tk.*[insert amount in figures and in words]* upon receipt by us of your first written demand accompanied by a written statement that the Tenderer is in breach of its obligation(s) under the Tender conditions, because the Tenderer:

- a. has withdrawn its Tender after opening of Tenders but within the validity of the Tender Security ; or
- b. refused to accept the Notification of Award (NOA) within the period as stated under Instructions to Tenderers (ITT) ; or
- c. failed to furnish Performance Security within the period as stipulated in the NOA; or
- d. refused to sign the Contract Agreement by the time specified in the NOA; or
- e. did not accept the correction of the Tender price following the correction of the arithmetic errors in accordance with the ITT; or

This guarantee will expire:

- (a) if the Tenderer is the successful Tenderer, upon our receipt of a copies of the contract signed by the Tenderer and the Performance Security issued to you in accordance with the ITT; or
- (b) if the Tenderer is not the successful Tenderer, twenty eight (28) days after the expiration of the Tenderer’s Tender validity period, being *[date of expiration of the Tender validity plus twenty eight(28) days]*

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

Letter of Commitment for Bank's undertaking for Line of Credit (Form PG5A-6a)

[This is the format for the Credit Line to be issued by any scheduled Bank of Bangladesh in accordance with ITT Clause 15.1(b)]

Invitation for Tender No:

Date:

Tender Package No:

Lot No (when applicable)

To:

[Name and address of the Procuring Entity]

CREDIT COMMITMENT No: [insert number]

We have been informed that [name of Tenderer] (hereinafter called "the Tenderer") intends to submit to you its Tender (hereinafter called "the Tender") for the execution of the Supply and Installation of Plant & Equipment of [description of works] under the above Invitation for Tenders (hereinafter called "the IFT").

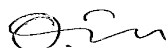
Furthermore, we understand that, according to your conditions, the Tenderer's Financial Capacity i.e. Liquid Asset must be substantiated by a Letter of Commitment of Bank's Undertaking for Line of Credit.

At the request of, and arrangement with, the Tenderer, we [name and address of the Bank] do hereby agree and undertake that [name and address of the Tenderer] will be provided by us with a revolving line of credit, in case awarded the Contract, for execution of the Works viz. [insert name of works], for an amount not less than BDT [in figure](in words) for the sole purpose of the execution of the above Contract. This Revolving Line of Credit will be maintained by us until issuance of "**Taking-Over Certificate**" by the Procuring Entity.

In witness whereof, authorised representative of the Bank has hereunto signed and sealed this Letter of Commitment.

Signature

Signature



Notification of Award (Form PG5A - 7)

Contract No:
To:

Date:

[Name of Contractor]

This is to notify you that your Tender dated *[insert date]* for the supply and installation of plant and Services for *[name of contract]* for the Contract Price of *[state amount in figures and in words]* as corrected and modified in accordance with the Instructions to Tenderers, has been approved by *[name of Employer]*.

You are thus requested to take following actions:

- i. accept in writing the Notification of Award within seven (7) working days of its issuance pursuant to ITT Sub-Clause 64.1
- ii. furnish a Performance Security in the specified format and in the amount of Tk.*[state amount in figures and words]* ,within Twenty-eight (28) days from issue of this Notification of Award but not later than (specify date), in accordance with ITT Clause 64.3
- iii. sign the Contract within twenty eight (28) days of issuance of this Notification of Award but not later than (specify date), in accordance with ITT Clause 69.2

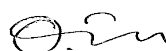
You may proceed with the execution of the supply of Plant and Services only upon completion of the above tasks. You may also please note that this Notification of Award shall constitute the formation of this Contract, which shall become binding upon you.

We attach the draft Contract and all other documents for your perusal and signature.

Signed

Duly authorised to sign for and on behalf of
[name of Employer]

Date:



Contract Agreement (Form PG5A - 8)

THIS AGREEMENT made the [day] day of [month][year] between [name and address of Employer] (hereinafter called “the Employer”) of the one part and [name and address of Contractor] (hereinafter called “the Contractor”) of the other part:

WHEREAS the Employer invited Tenders for certain plant and services, viz, [brief description of plant and services] and has accepted a Tender by the Contractor for the supply of those plant and services in the sum of Taka [Contract Price in figures and in words] (hereinafter called “the Contract Price”).

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the General Conditions of Contract hereafter referred to.
2. The following documents forming the Contract shall be in the following order of precedence, namely :
 - (a) the signed Form of Contract Agreement;
 - (b) the Notification of Award
 - (c) The Tender and the appendices to the Tender
 - (d) Particular Conditions of Contract;
 - (e) General Conditions of Contract;
 - (f) Technical Specifications;
 - (g) Drawings;
 - (h) Price Schedules of Plant and Equipment and;
 - (i) other document including correspondences listed in the PCC forming part of the Contract
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to provide the plants and related services and to remedy any defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the provision of the plant and services and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
5. The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement. Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS whereof the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives in accordance with the laws of Bangladesh on the day, month and year first written above.

Signed by, for and on behalf of the Employer

For the Employer:

For the Contractor:

Signature

Print Name



Title

In the presence of

Name

Address



Bank Guarantee for Performance Security (Form PG5A – 9)

[This is the format for the Performance Security to be issued by an internationally reputable bank and it shall have correspondent bank located in Bangladesh, to make it enforceable in accordance with ITT Sub-Clause 67.1 pursuant to Rule 27(4) of the Public Procurement Rules, 2008.]

Contract No:

Date:

To:

[Name and address of Employer]

PERFORMANCE GUARANTEE No: *[insert Performance Guarantee number]*

We have been informed that *[name of Contractor]* (hereinafter called “the Contractor”) has undertaken, pursuant to Contract No *[reference number of Contract]* dated *[date of Contract]* (hereinafter called “the Contract”) for the supply and installation of *[description of plant and services]* under the Contract.

Furthermore, we understand that, according to your conditions, Contracts must be supported by a performance guarantee.

At the request of the Contractor, we *[name of bank]* hereby irrevocably and unconditionally undertake to pay you, without cavil or argument, any sum or sums not exceeding in total an amount of Tk. *[insert amount in figures and in words]* upon receipt by us of your first written demand accompanied by a written statement that the Supplier is in breach of its obligation(s) under the Contract conditions, without you needing to prove or show grounds or reasons for your demand of the sum specified therein.

This guarantee is valid until *[date of validity of guarantee]*, consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

[Signatures of authorized representatives of the bank]

Signature

Seal



Bank Guarantee for Advance Payment (Form PG5A – 10)

[this is the format for the Advance Payment Security to be issued by an internationally reputable bank and it shall have correspondent bank located in Bangladesh, to make it enforceable in accordance with GCC Clause 57.1]

Contract No:

Date:

To:

[Name and address of Employer]

ADVANCE PAYMENT GUARANTEE No.:

We have been informed that *[name of Contractor]* (hereinafter called “the Contractor”) has undertaken, pursuant to Contract No *[reference number of Contract]* dated *[date of Contract]* (hereinafter called “the Contract”) for the supply and installation of *[description of plant and services]* under the Contract.

Furthermore, we understand that, according to your Particular Conditions of Contract Clause 26.1, Advance Payment(s) on Contracts must be supported by a bank guarantee.

At the request of the Contractor, we *[name of bank]* hereby irrevocably unconditionally undertake to pay you, without cavil or argument, any sum or sums not exceeding in total an amount of Tk. *[insert amount in figures and in words]* upon receipt by us of your first written demand accompanied by a written statement that the Contractor is in breach of its obligation(s) under the Contract conditions, without you needing to prove or show grounds or reasons for your demand of the sum specified therein.

We further agree that no change, addition or other modification of the terms of the Contract to be performed, or of any of the Contract documents which may be made between the Employer and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee is valid until *[date of validity of guarantee]*, consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

[Signatures of authorized representatives of the bank]

Signature

Seal

Bank Guarantee for Retention Money Security (Form PG5A-11)

[This is the format for the Retention Money Guarantee to be issued by any scheduled Bank of Bangladesh in accordance with GCC Clause 57]

Demand Guarantee

[Bank's Name, and Address of Issuing Branch or Office]

Beneficiary: [insert Name and Address of the Procuring Entity]

Date: [insert date]

RETENTION MONEY GUARANTEE No.: [insert number]

We have been informed that [insert name of Contractor] (hereinafter called "the Contractor") has entered into Contract Number [insert reference number of the Contract] dated [insert date] with you, for the execution of [insert name of Contract and brief description of Works] (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment, payment of Tk. [insert the amount of the second half of the Retention Money] which becomes due after the Defects Liability Period has passed and certified in the form of Defects Correction Certificate, is to be made against a Retention Money Guarantee.

At the request of the Contractor, we [insert name of Bank] hereby irrevocably unconditionally undertake to pay you any sum or sums not exceeding in total an amount of Tk. [insert amount in figures] (Taka [insert amount in words]) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor failed to properly correct the defects duly notified in respect of the Supply and Installation of Plant & Equipment.

It is a condition for any claim and payment under this guarantee to be made that the payment of the second half of the Retention Money referred to above must have been received by the Contractor on its account number [insert A/C no] at [name and address of Bank].

This guarantee is valid until [insert the date of validity of Guarantee that being twenty-eight (28) days beyond the Defects Liability Period]. Consequently, we must receive at the above-mentioned office any demand for payment under this guarantee on or before that date.

Section 6. Employer's Requirements

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6.1 Scope of Supply of Plant and Installation Services by the Contractor

6.1.1 General:

The works covered by the Bid/Tender is Design, Supply, Erection, Installation, Testing and commissioning of 04 (Four) nos. 33 KV Line Feeder with 4D (5mX5m) Bay extension (33 kV side works, Grid substation) at Sherpur, Bogura including Civil works and other related works on Turnkey Basis under ***Superintending Engineer (Procurement), NESCO, Rajshahi.***

The scope of Plant & Equipment and services include design, manufacture, quality assurance, erection, dismantling (where required), inspection & testing, packing for export, insurance & shipment to site, complete construction & installation, jointing, terminating, bonding, earthing, painting, transportation, setting to work, site testing & commissioning of all the equipment necessary for safe operation of the Bay Extension. Moreover, the existing equipment dismantled from the existing substation shall be handed over and deposited to Grid-Incharge, Sherpur 132/33 KV Grid Substation, Sherpur/Divisional Store of NESCO without any damage as per direction of NESCO authority or Engineer of this project.

Shifting/Modification of any existing scheme of equipment to new equipment in up gradation work scope shall be deemed included in the scope. The detail requirement is listed in the technical specification and Guaranteed Technical particulars (GTP) in the bid document.

The contractor shall bear all the costs regarding transportation of the equipment to the site.

The contractor is responsible for ensuring that all and any items of work required for the safe efficient and satisfactory completion and functioning of the works.

The Bidders are advised to conduct site visits, to inform themselves and to carry out their own assessment on concern sites according to their needs before the submission of their bids. The Employer may arrange necessary permission, if required by the Bidders.

The drawings provided in the bidding documents are indicative only and hence do not reflect the entire Scope of works. The Bidder has to consider all Bid drawings as preliminary and for Bid purpose Only. The drawings may be changed for betterment at the time of execution. All dimensions are preliminary and general.

Not all equipment is shown on the drawings. Details are not shown at all. The Contractor has to make Engineering and to provide detail calculation, detail design and detail drawings of the complete facilities, which will be subject of the Employer's approval

Moreover, the contractor shall be responsible for transportation of machineries/ equipment to Project Site including moving the equipment and materials from the designated store to the site shall be done by the contractor as per Consignee's advice and requirement and during the testing, commissioning, functional operation all the consumables goods or any equipment/machineries/materials are required to complete the Plant & Equipment and services shall be the responsibilities of the contractor and all the necessary arrangement for Power, Water, accommodations or any such facilities and tools-tackles and necessary instruments for erection, dismantling, installation, testing and commissioning of the Project Site will be supplied/ arranged by the Contractor within the quoted price.

The contractor should hand over all the removed materials/ goods at the place within Layout plan as instructed by the Consignee.

Important Notes:

- 1. Scope of works also includes all items described in price schedule, BOQ, Single line diagram (SLD). Bidders are notified here clearly & no excuse will sustain after contract agreement in this case.**
- 2. Bidders are required to provide a fixed Turnkey Contract Price for the Plant & Equipment and services outlined in the Price Schedule detailed in Sections 5 & Section 6,7, 8, 9 of this Tender document.**
- 3. The BOQ is a list of items only, the actual quantity will be supplied by the turnkey contractor to complete the work. If additional quantity is required after the contract (for completing the work) no extra payment will be made.**
- 4. If any item that is not included in BOQ/Scope of work but is mandatory for completing Design, Supply, Erection, Installation, Testing and Commissioning of the substations, bidder will include the price of the item in financial offer during bidding.**
- 5. Inspection & testing of different substation equipment at manufactures premises will be conducted by the NESCO Engineers according to as per relevant clause.**
- 6. Bidder must visit the sites prior to bid submission. According to site requirement bidder will quote price for civil works.**

6.1.2 Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with 4D (5mX5m) Bay extension at Sherpur, Bogura Grid Substation on Turnkey Basis.

(Not limited but at least the following works to be done by the turnkey contractor)

A. CIVIL & BUILDING WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning and so on of the following works are the scope of works:



- 1) Land development, land escaping, leveling, dressing, supply of gravel (Minimum 200 mm from Brick soling surface for whole switchyard area) and finishing the switchyard surface by the gravel to the switchyard.
- 2) Soil testing for soil resistivity, final leveling, consolidation, surfacing and compaction of switchyard area with crushed rock (where required) to cater for the ultimate development of the substation (only for 4 nos. proposed 33 KV line feeder with 4D (5mX5m) Bay extension).
- 3) Dismantling work (If necessary) as per Price Schedule, BOQ & field requirement.
- 4) Land development work with height of 1(One) Meter above the highest flood level or 1 (One) Meter above the nearest highway/road level which is higher (if necessary). Employer will provide all lands only and contractor will fill it by sand (if necessary) up to ground level. Soil testing for soil resistivity and soil bearing capacity before designing, final leveling, consolidation, surfacing and compaction of entire switchyard area with crushed rock (where required) to cater for the ultimate development of the substation.
- 5) Construction of R.C.C foundations for Gantry tower, Circuit Breaker, Current Transformer, Post Insulator & LA Structure, construction of R.C.C foundations for horizontal break isolator & if required for any other equipment & Structure.
- 6) Construction of RCC approach road only for dismantled portion of existing approach road after constructing road crossing 33KV Power cable trench.
- 7) Construction of cable trenches for power cable & control cable:
 - a) RCC Cable trench for power cable switchyard area to overhead pole as required and as per PGCB approved layout.
 - b) For control cable at new Switchyard area to existing 33KV Switch yard control cable trench. New Control cable trench with slab and rack must be dimensionally identical with existing control cable trench and slab at 33KV Switch yard.
 - c) For control cable existing cable trench will be used. If any kind of difficulty arises regarding use of existing control cable trench, renovation/construction of control cable trench will be done.
 - d) 33 KV Cable Trenches at ground level with RCC Cover slab shall be constructed in the available space and overhead cable tray (with hot deep galvanized checkered plate) at cable room along, subject to the proper approval (If necessary). The overhead Cable tray shall be constructed so that 90 degree or sharp bending of cable is always eliminated while going up from the underground.
 - e) 33KV Power cable trench (For 2 nos outgoing 33KV feeder) will cross a 4.5 width and 0.35m thick RCC approach road road at east side of 33KV switch yard. Contractor will cut the road at crossing point and construct special designed road crossing cable trench with slab and reconstruct the RCC road as it was. Contractor will take proper design approval from Civil Division, NESCO, Rajshahi before constructing Control and Power cable trench.

- f) Contractor will replace damaged slabs of power and control cable trench of substation during works (If necessary).
- g) Proper sealing of the cable entry (control & Power) at Control Room building, to prevent water entering from switch yard/outside to CR Building, preventing entry of rats and reptiles, Fire proof etc.
- 8) Construction of surface drain for new switch yard and connect it to existing drainage system of PGCB.
- 9) Supply and Installation of Yard Lighting (LED) & Emergency Lighting (LED). All the light fittings shall be LED type & these fittings shall be mounted on switch yard portal structures such as columns & beams. No separate lighting mast is required. Entire substation lighting system in the switch yard shall be designed using underground cables only. No overhead conductors are permitted for this purpose. For street lighting one outdoor lighting kiosk with two incomers of 200A rating switch fuse units (SFU) & with six feeders of 32A rating fitted with MCB shall be considered. Lighting within the switchyard must be designed as per relevant IEC standard to achieve the following minimum lighting levels:
 - Minimum 20 lux within the main working areas;
 - Minimum 60 lux at major plant items including marshalling boxes and control cubicles
- 10) Switchyard lighting must consist of weather proof LED floodlights and switched from inside the building. Floodlights should be a suitable high quality, energy efficient light installed at 45-60 degrees or an angle suitable to maximize the effectiveness of the light. Lighting poles must be Hot Dipped Galvanized and hinged at the base or mid-way up the pole to ensure maintenance is capable of being performed at ground level without the use of ladders or elevated work platforms. The design must check swing down or hinged poles with the proximity to HV equipment to ensure exclusion zones are not encroached when performing floodlight maintenance.
- 11) Civil works in substation control room building as required for installation of 33 KV PCM Panel.

B. SUB-STATION / ELECTRICAL WORKS:

Design, Manufacture, Supply, Installation/ Erection, Construction, Testing and Commissioning etc. of the following works are the scope of works:

- 1) Supply and installation of 04 (Four) nos. 33kV Line Feeders with 4D (5mX5m) Bay extension comprising: 33kV VCB, CT, DS, LA, DS with ES, Control cable, Cable termination kit, PCM Panel, Supporting structures etc.
- 2) Supply and installation of 04 (Four) Sets 36 kV, 1600A, 31.5 KA, for 3 Sec outdoor type Vacuum circuit breaker along with accessories.
- 3) Supply and installation of 04 (Four) Set 33 kV Protection, Control Metering Panels for 33 kV Line Feeders with relay Directional O/C + Directional E/F. All the Circuit

Breaker's control with Local/ Remote switch, metering and status data shall be provision for interfacing with Substation Automation System & SCADA System.

- 4) Supply and installation of 04 (Four) Sets 33 kV, Single phase Lightning Arrester (Polymar insulator, ZnO-type) including surge Monitor/counter, Supporting Steel Structure and other accessories.
- 5) Supply and installation of 04 (Four) Sets 33 kV Isolator (1600 A, 31.5 KA, for 3 Sec.) without earthing blade gang operated vertical mounted vertical break with supporting steel structure with necessary connectors and accessories.
- 6) Supply and installation of 04 (Four) Sets 33 kV Line Isolator (1600A, 31.5 kA for 3 sec) with earthing blade gang operated (02 nos vertical mounting, vertical break and 02 nos horizontal mounting, horizontal break) with supporting steel structure with necessary connectors and accessories.
- 7) Supply and installation of 01 (One) Sets 33 kV Sectionalizing Bus Isolator (2500A, 31.5 kA for 3 sec), gang operated, horizontal mounting, horizontal break, without earthing blade with supporting steel structure with necessary connectors and accessories to be installed on the top of the middle portion of the switchyard gantry structure.
- 8) Supply and installation of 1 (one) set 33 kV Off Load Fused Isolator (400A) along with fuse and supporting steel structure with necessary connections and accessories for 33 KV PT.
- 9) Supply and installation of 04 (Four) Sets 33 KV single phase Current Transformer 600-1200/5-5-5A (02 nos measuring core & 01 nos protection core), class 5P30, 0.2S & 30 VA along with supporting structure and suitable bi-metallic connectors and with accessories.
- 10) Supply and installation of 33kV Bus Potential Transformer of ratio $\frac{33kV}{\sqrt{3}}$ $\frac{110V}{\sqrt{3}}$ $\frac{110V}{\sqrt{3}}$ 01 set (three nos. in one set), to be installed on the switch yard gantry structure.
- 11) Power evacuation will be carried out through two-line feeders via underground cables (By Post Insulator Structure) and two-line feeders via overhead lines. Contractor will install necessary arrangements for power evacuation.
- 12) Installation of NESCO supplied 900m 33 KV, 1C×500 mm² power cable (XLPE, Copper Cable) for 02 (Two) nos 33 KV line feeder.
- 13) The scope of this bid includes the transportation, handling, and delivery of 33 kV 1CX500 RM underground cable from the NESCO Store located in Rajshahi or Rangpur. The selected bidder shall be responsible for all activities related to the loading, transportation, unloading, and safe handling of the cable from the designated NESCO store to the project site including supply of all termination kits and accessories for connection from 02(Two) nos 33 KV horizontal mounting line isolator to 33 KV outgoing overhead pole as per approved design & drawing and instruction of Engineer in charge of NESCO.
- 14) Supply & installation of All Cable termination kit/lug (33KV) along with all requirements.
- 15) Supply of Control cable of different sizes and LV PVC copper cable of different sizes as

- necessary and MCCB, connectors to connect different panes/ auxiliary transformer etc.- 4x4mm², 4x6 mm², 4x2.5 mm², 8x2.5 mm², 16x 2.5 mm², 24x 2.5 mm², 12x 2.5 mm², 19x 2.5 mm², 2x 10 mm², 2x 2.5 mm², 14x 2.5 mm², 2x 4 mm² or as per requirement. These items must be approved from NESCO.
- 16) Supply & installation of Cu Bus bar for connecting outgoing side of 33KV Horizontal Line Isolator to XLPE Cu Cable. Following facts should be considered- Cross section of Copper Bus bar shall be of minimum size (1000 mm²).
 - 17) Supply And Installation of Sub-Station Galvanized Steel Structure Materials Of 4D (5mx5m Each) and 04 (Four) Bay for Supporting 33 Kv Bus Section with Bus Bar, Bus Support Insulator & Hardware, Jumper, Shielding Materials and Grounding Materials Etc. Complete In all Respect.
 - 18) Supply and installation Supporting steel column structure for connecting the 33KV Power Cable and all other Supporting steel column structure with accessories as required.
 - 19) Supply and installation of 33KV Disc Insulator set or **Insulators as per requirement** with necessary suitable front and back connecting clamps. 33 KV Disc insulators with tension clamp for 02 nos overhead line feeder are also within the scope.
 - 20) Supply and installation of 33 kV busbar Conductor for the whole substation with ACSR MARTIN (Twin) conductor.
 - 21) Supply and installation Suitable bus bar droppers (ACSR-MARTIN), conductors, connectors & outdoor marshaling kiosk, hardware clamps, nut bolts etc. suitable for individual item of substation circuit equipment for complete substation. **Detailed drawings of all types of connectors must be submitted for approval to the NESCO Design and Inspection Division.**
 - 22) Supply and installation of a) Terminal Tension clamp with fittings, b) PG Clamp set for fixing the shield wire with the gantry steel structure, c) Support clamp
 - 23) Supply and installation of Switch yard shielding materials.
 - 24) Supply & install of minimum 150 mm² grounding bare copper conductor & Grounding rod (Earthing electrode, of copper) dia 16 mm. Ground Conductor have to be laid surrounding and within the switch yard area creating a mesh with minimum 0.6m depth. Actual Shape of mesh, electrode length, depth, conductor dia etc will be according to design calculation. Consider short circuit current 40 KA for 1 second and allowable person weight minimum 50 KG and step and touch potential as per IEEE or IEC standard and calculation.
- Details calculation of earthing resistance, step & touch potential must be approved from NESCO before any work starts.**
- 25) Supply and installation of Suitable connector for connecting with individual items of Substation equipment between Sub-station equipment and earthing mesh. Inter connections between mesh grounding conductors, electrodes, rising conductors must be cad welded.

- 26) Supply and installation/ connection of all types of Control Cables.
- 27) 05 (Five) sets of As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Superintending Engineer, Design & Inspection Department, NESCO, Rajshahi. 01 (One) set of all approved design drawing, GTP, Equipment catalogue in a bound book and one electronic copy (soft copy in a pen drive, Drawings with AutoCAD format) of all relevant As-built drawings together with operation and maintenance manual, relevant IEC standards of the installed equipment shall be submitted for the Superintending Engineer of Design & Inspection Department, NESCO, Rajshahi.
- 28) The Tenderer must visit the site and assess the works before tender submission.
- 29) Dismantling any existing structure as required, Transportation of all equipment and materials, all installations, connections and testing, commissioning, inspection are within the scope of the Bid.
- 30) Under this project bidder shall ensure the **seamless integration of only new 02 (Two) bay (NESCO) with GE SCADA System at Master Control Center**. The bidder is responsible for performing **all necessary data and hardware engineering** including
- Providing inter-operable data at GE SCADA ADMS Control Centre.
 - New SCADA database, display development in GE Vernova SCADA /ADMS Software at Control Centre.
 - End to end testing and DATA Validation at Main Control Centre end.
 - In case of integration in IEC 101 /104 protocol, procuring associated terminal server license (If necessary).
 - GIS file for added new feeder & customer data for additional new bay while preparing the ADMS database in Control Centre.
 - Testing of the Software.
 - Preparing and updating communication topology.
 - alarm database modelling.
 - end to end testing required for the SCADA integration, in close coordination with authorized representatives from **EATON and GE Vernova**.

Before finalizing the price schedule, the bidder will undertake the following activities:

- Gather all necessary documents related to upcoming **GE SCADA** to ensure seamless integration and compliance.
 - Conduct a comprehensive site visit to assess existing infrastructure, connectivity, and operational conditions.
 - Evaluate onsite requirements, identify potential gaps, and determine the necessary resources for successful project execution.
- 31) The newly built 02 (Two) Bay for NESCO requires seamless integration into the NESCO GE SCADA System and ADMS, necessitating the establishment of optical fiber communication links. It must be connected to the Telecom Equipment installed at





Sherpur 132/33 KV Grid Control Room, PGCB via ADSS optical fiber other essential equipment's for successful integration.

The bidder shall be responsible for supplying all necessary components and performing any additional work required to ensure the seamless integration of the new panel/feeder/bay with the GE SCADA System, even if such items, components, or tasks are not explicitly mentioned in this scope.

- 32) If it is deemed necessary of any additional machineries/equipment/ materials / Supply and Related Services (as outlined in the scope of works), beyond what is listed in the tender Price Schedule, in order to accomplish the Turnkey project, the contractor must execute these additional works (Supply and Related Services) at no additional expense. The expenses associated with these additional works (Supply and Related Services) are understood to be encompassed within the initially quoted price.
- 33) Design, Installation, Erection, Delivery, Testing & Commissioning of each part of the whole substation as per Technical Specification, GTP & SLD. Transportation of all equipment and materials & connections are within the scope of the Bid.
- 34) Installation, Erection, Testing, Commissioning of each part of the whole substation As per Technical Specification, GTP & SLD.
- 35) List of mandatory spare parts (Items in the list must be of same model & manufacturer of supplied main equipment):

Sl. No.	Description	Location	Unit	NESCO's Requirement
1	Tripping coil	33 KV VCB	Nos	2
2	Closing coil	33 KV VCB	Nos	2
3	Charging Motor	33 KV VCB	Nos	2
4	Master Tripping Relay	33 KV VCB Panel	Nos	2
5	Trip Circuit supervisionRelay	33 KV VCB PCM Panel	Nos	2
6	Overcurrent & Earth fault relay	33 KV VCB PCM Panel	Nos	2
7	Annunciator	33 KV VCB PCM Panel	Nos	2
8	33KV Single Phase LA (Offered Type)	Switchyard	Set (1Set = 3 Nos)	2
9	33KV 1CX500 rm Cable Termination Kit (Outdoor Type)	Switchyard	Set (1Set = 1 Nos)	6

C. Design and Drawings:

01. Single Line Diagram of Sub-station.
02. Site Layout Plan and arrangement drawings of Sub-station.

03. Proposed lay-down area for construction purposes.
04. Detailed soil investigation program where required, soil test report.
05. All Civil Drawing. All drawings and designs as per Section 7 (architectural, foundation and super structure)
06. Installation drawings, lay out, grounding/earthing design, Lightning protection.
07. All details Specification, GTP, General Arrangement, Electrical, Mechanical, Dimensional, Cross-Sectional, Connection Drawing for equipment described in Price Schedule.
08. As Built Drawings.
09. Others as required.

All drawings shall have to be submitted hardcopy, softcopy & AutoCAD soft copy format.

Design, drawing diagrams, Specification and Technical Particulars & Guarantees etc., along with Outline, Dimensional, Cross-sectional & General arrangement drawings, Installation diagram, printed catalogue describing the type/ model of offered every equipment shall be submitted to the Superintending Engineer, Design & Inspection, NESCO Ltd, Rajshahi by the Bidder.

The submitted Design, drawing diagrams, Specification and Technical Particulars & Guarantees etc. must be approved by Design & Inspection, NESCO Ltd, Rajshahi prior to the manufacturing of the goods.

The Bidder shall have to submit 3 (three) sets of the same for Approval within 30 days from the date of signing Contract. The bidder shall also submit one set reproducible tracing of the above drawings in soft format.

(a) Bill of Quantities (BOQ)

All the items mentioned in the BOQ (as follows) shall be quoted in the respective format of the price schedule, otherwise bid will be rejected.

Tenderer shall quote a Firm Turnkey Contract Price for the Supply and Related Services as described in Price Schedule according to Section 6, Section 7 & Section 8 of this Tender document. If the Tenderer deemed necessary any additional machineries/equipment/materials / Supply and Related Services out of the list of tender Price Schedule for completion of the said Turnkey basis works (Supply and Related Services), contractor shall have to do the additional works (Supply and Related Services) without any additional cost. The costs of these additional works (Supply and Related Services) are deemed to be included within the quoted price.

6.1.3.1 Bill of Quantities for Design, Supply, Erection, Installation, Testing and Commissioning of 04 (Four) nos. 33 kV Feeders with 4D(5mX5m) Bay extension at Sherpur, Bogura Grid Substation under NESCO, Rajshahi on Turnkey Basis.

Line Item No.	Description of Item	Quantity

1	2	3	
A	33KV VCB & PCM PANEL		
1	Supply Of 36 KV 1600A, 31.5 KA For 3 Sec Outdoor Type VCB along with accessories (As Per Scope of Works, Technical Specification And GTP).	Set	4
2	Supply Of 33 KV Protection, Control Metering Panel For 33 KV Line Feeder with Numerical Relay (Directional O/C + Directional E/F & Non-Directional O/C + E/F). All The Circuit Breaker's Control with Local/ Remote Switch, Metering and Status Data shall have provision for Interfacing with Substation Automation System & SCADA System. (As Per Scope of Works, Technical Specification, GTP & SLD).	Set	4
B	33KV LIGHTENING ARRESTER		
3	Supply Of 33 KV, Single Phase Lightning Arrestor (Polymer Insulation-ZnO-Type) including Surge Monitor/Counter along with supporting structure and along with accessories (As Per Scope of Works, Technical Specification And GTP)	Set (1 set= 3 nos.)	4
C	33KV ISOLATOR WITH AND WITHOUT EARTH BLADE		
4	Supply of 33 KV Isolator (1600A, 31.5 KA for 3 sec) without earthing blade gang operated vertical break with supporting steel structure with necessary connections and accessories for outgoing feeders at Bus side (As per scope of works, Technical Specification and GTP).	Set	4
5	Supply Of 33 KV Isolator (1600A, 31.5 KA For 3 Sec) With Earthing Blade Gang Operated (02 nos Horizontal mounting, Horizontal Break & 02 nos vertical mounting, vertical break) with Supporting Steel Structure with Necessary Connections and Accessories (As Per Scope of Works, Technical Specification And GTP)	Set	4
6	Supply Of 33 KV Bus Section Isolator (2500A, 31.5 KA For 3 Sec) Without Earthing Blade Gang Operated Horizontal Structure for Installation on Gantry Steel Structure with Necessary Connections and Accessories (As Per Scope of Works, Technical Specification And GTP).	Set	1
7	Supply of 33 KV off load fused Isolator (400A) along with fuse and supporting steel structure with necessary connections and accessories for 33 KV PT & Auxiliary transformers (As per scope of works, Technical Specification and GTP)	Set	1
D	33KV CT & PT		
8	Supply Of 33 KV Single Phase Current Transformer 600-1200/5-5-5A (Core-1: Indicating Meter on PCM Panel, Core-2: Energy Meter, Core-3: Protection) Class 5P30, 30VA And 0.2S Along with Supporting Structure and Suitable Bi-Metallic Connectors and With Accessories for Line Feeder (As Per Scope of Works, Technical Specification And GTP)	Set (1 set= 3 nos.)	4
9	Supply Of 33 KV Single Phase Potential Transformer (Ratio 33/√3/.11/√3/.11/√3 KV) Class 0.2, 50VA And 3P Along with Supporting Structure and Suitable Bi-Metalic Connectors and With Accessories (As Per Scope of Works, Technical Specification And GTP)	Set (1 set= 3 nos.)	1
E	33 KV UG CABLE TERMINATION, CONTROL CABLES & COPPER BUS BAR		

10	Supply of All Control cables of different sizes and all LV PVC copper cable of different sizes as necessary for Grounding LA, VCB, CT, Gantry Structure etc and MCCB, connectors to connect different panels/auxiliary transformer etc. 4Cx4mm ² , 4Cx6mm ² , 4Cx2.5mm ² , 8Cx2.5mm ² , 14Cx 2.5mm ² , 16Cx 2.5mm ² , 19Cx 2.5mm ² , 24Cx2.5 mm ² etc including all accessories. (As per Scope of Plant & Services, Technical Specification and GTP).	Lot	1
11	33 KV Cable termination kit (Outdoor 1Cx500 sq.mm XLPE (Cu) Power Cable) along with all requirements for connection for Outgoing feeder.	Set	12
12	Cu Bus bar for connecting outgoing side of 33KV Horizontal Line Isolator to XLPE Cu Cable. Following facts should be considered- Cross section of Copper Bus bar shall be of minimum size (1000 mm ²) (As per Scope of Plant & Services, Technical Specification and GTP).	Lot	1
F	STEEL STRUCTURES & BUS COMPONENTS, CONDUCTORS, CONNECTORS & INSULATORS		
13	Supply Of Substation Hot Dip Galvanized Steel Structure Material For 4D Each 5M X 5M Along with Suitable Beam For 33 KV Bus Section and All Other Necessary Accessories for Installation of Equipment (As Per Scope of Works, Technical Specification And GTP)	1 D (5mx5m)	4
14	Supply Of Supporting Steel Column Structure For 33KV VCB, CT, LA, Post Insulator Structure (For 2 Bay within 4), Vertical Isolator & Connecting The 33 KV Power cable with the necessary Connecting Clamps, Insulators as Required for 4 Bay (As Per Scope of Works, Technical Specification And GTP)	Lot	1
15	33 KV Disk Insulator set with Necessary Suitable Front and Back Connecting Clamps (As Per Scope of Works, Technical Specification And GTP)	Lot	1
16	Supply 33 KV Bus Bar Conductor ACSR MARTIN (Twin), Bus Capacity - 3000A (As Per Scope of Works, Technical Specification And GTP)	Lot	1
17	Suitable Busbar Droppers (ACSR MARTIN-Single Loop), Conductors, High Grade AL alloy Connectors and Outdoor Marshaling Kiosk, Necessary Hardware for All Suitable Connections to Each Substation Equipment, Clamps, Nut-Bolts etc. (As Per Scope of Works, Technical Specification And GTP)	Lot	1
18	Supply Of Shield Wire Overall Diameter Of 9.525 Mm Standard Steel (As Per Scope of Works, Technical Specification And GTP)	Lot	1
19	Supply Of Terminal Tension Clamp with Fittings and PG Clamps Set for Fixing the Shield Wire with The Gantry Steel Structure (Tension Clamp, PG Clamp, Supporting Clamp) (As Per Scope of Works, Technical Specification And GTP)	Lot	1
G	EARTHING SYSTEM		
20	Supply of minimum 150 mm ² grounding bare copper conductor & Grounding rod (Earthing electrode, made of copper) dia 16 mm. Ground Conductor have to be laid surrounding the switch yard area creating a mesh with minimum 0.6m depth. Length of grounding rod will be finalized during earth resistance calculation. Actual	Lot	1

	Shape of mesh, electrode length, depth, conductor dia etc will be according to design calculation. Consider short circuit current 40 KA for 1 second and allowable person weight minimum 50 KG and step and touch potential as per IEEE or IEC standard and calculation. Earth resistance of new switchyard must be below 0.5 ohm (during test) and 0.4 ohm (during calculation) at dry season (As per scope of works, Technical Specification, GTP & SLD).		
21	Supply Of Suitable Connectors for Connecting with Individual Item of Substation Equipment Between Substation Equipment and Earthing Mesh (As Per Scope of Works, Technical Specification And GTP)	Lot	1
H	SCADA INTEGRATION		
22	Addition of new Panel/Bay with Necessary Hardware, Software (If Required) and as Build Drawing in GE SCADA System with complete integration completion of all necessary works as per brief description of works (For all replaced and new bay/feeder seamless GE SCADA integration)	Nos (Bay- NESCO)	2
I	MANDATORY SPARE PARTS		
23	33KV Circuit Breaker Closing Coil (offered type).	Nos.	2
24	33KV Circuit Breaker Tripping Coil (offered type)	Nos.	2
25	33 KV Circuit Breaker Charging Motor (offered type)	Nos.	2
26	33 KV PCM Panel Master Tripping Relay (offered type)	Nos.	2
27	33 KV PCM Panel Trip Circuit Supervision Relay (offered type)	Nos.	2
28	33 KV PCM Panel Annunciator	Nos.	2
29	33kV Single Phase Lightning Arrestor (Station Class) (offered type)	Set	2
30	33 KV 1CX500 mm Cable Termination Kit (Outdoor Type)	Set	6
J	CIVIL WORKS		
31	Earth filling, Land escaping, Leveling, dismantling if required, Dressing / Preparation of Land, Soil Testing (As per scope of works, Technical Specification, GTP & SLD).	Lot	1
32	Civil works in the existing control room building as required for installation of 33 KV Control Relay Panel.	Lot	1
33	Supply materials and Construction of Foundation of all Equipment and gantry Structure including CB, CT, LA & PI, DS etc (As per scope of works, Technical Specification, GTP & SLD).	Lot	1
34	Surface Finishing with gravels for new Sub-station area (As per scope of works, Technical Specification, GTP & SLD).	sq.m	250
35	Supply materials and construction of approach road (Only for dismantled part of RCC Approach Road for Road Crossing 33KV Power cable trench) & internal road as per site requirements (As per scope of works, Technical Specification, GTP & SLD).	sq.m	10
36	Supply materials and construction of surface drain (As per scope of works, Technical Specification, GTP & SLD).	Rm	15
37	Supply materials and construction of RCC Cable Trench with slab	Rm	130

	& cable rack for power cable laying including RCC Road Crossing Cable trench. (As per scope of works, Technical Specification, GTP & SLD).		
38	Supply materials and construction of RCC Cable Trench with slab & cable rack for Control Cable laying. *** Must be identical with existing cable trench & Slab width, height, thickness in existing 33KV Switch Yard. (As per scope of works, Technical Specification, GTP & SLD).	Rm	30
39	Supply of LED Flood Lights, 240 Volts Single Phase with shade & Fittings and other related accessories (As per scope of works, Technical Specification, GTP & SLD).	Set	8
J	DESIGN DOCUMENTS & INSTALLATION		
40	All Design, Drawing and Documentation works including 05 (Five) Sets of As-Built drawings (whole substation & control room), Approved Drawings & GTP and substations operation and maintenance manual (Drawings in AutoCAD format) in a Bound Book (As per Scope of Works, Technical Specification and GTP).	LS	1
41	Installation, Carrying of all materials, Integration, Inspection, Erection, Testing & Commissioning of the Substation (As per Scope of Works, Technical Specification and GTP).	Lot	1

6.2 Specification: As Per Section 7

[Templates/Tables should be provided below:]

The Plant & Equipment shall comply with following Technical Specifications:

Item No	Name of Item or Related Service	Technical Specification and Standards
1	2	3
Lot No 1: [enter description]		
	<i>[add as many rows and details as there are individual items in the Lot]</i>	<i>[The Purchaser must explain in clear terms the exact Technical Specification and any relevant National or International Standards which have to be followed for the manufacture and supply of the Plant & Equipment. <u>Technical Specifications shall specify what inspection and/or tests the Purchaser requires and where they are to be conducted</u>]</i>
1	Inspection and Tests	The following inspections and tests shall be performed: <i>[insert list of inspections and tests]</i>
Lot No 2: [enter description]		
	<i>[add as many rows and details as there are individual items in the Lot]</i>	

6.3 Form of Completion Certificate

Contract No:

Date:

To:

[Name of Contractor]

Pursuant to GCC Clause 39 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated *[insert date]*, for the supply and installation of plant and Services for *[name of contract]*, we hereby notify you that the following

part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof: _____
2. Date of Completion: _____

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

for and on behalf of the Employer

[***Signature***]

[***Title of the Project Manager***]

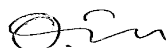
6.4 Form of Operational Acceptance Certificate

Contract No:
To:

Date:

[*Name of Contractor*]

Pursuant to GCC Clause 40.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated [*insert date*], for the supply and installation of plant and Services for [*name of contract*], we hereby notify you that the Functional



Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof: _____

2. Date of Operational Acceptance: _____

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

for and on behalf of the Employer

[*Signature*]

[*Title of the Project Manager*]

6.5 Form of Change Order Procedure and Forms

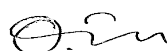
Contract No:
To:

Date:

[*Name of Contractor*]

CONTENTS

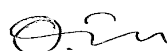
1. General



2. Change Order Log
3. References for Changes

ANNEXES

- Annex 1 Request for Change Proposal
- Annex 2 Estimate for Change Proposal
- Annex 3 Acceptance of Estimate
- Annex 4 Change Proposal
- Annex 5 Change Order
- Annex 6 Pending Agreement Change Order
- Annex 7 Application for Change Proposal



Change Order Procedure

1. General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GCC Clause 64 (Change in the Facilities) of the General Conditions.

2. Change Order Log

The Contractor shall keep an up-to-date Change Order Log to show the current status of Requests for Change and Changes authorized or pending, as Annex 8. Entries of the Changes in the Change Order Log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

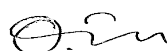
3. References for Changes

- (1) Request for Change as referred to in GCC Clause 64 shall be serially numbered CR-X-nnn.
- (2) Estimate for Change Proposal as referred to in GCC Clause 64 shall be serially numbered CN-X-nnn.
- (3) Acceptance of Estimate as referred to in GCC Clause 64 shall be serially numbered CA-X-nnn.
- (4) Change Proposal as referred to in GCC Clause 64 shall be serially numbered CP-X-nnn.
- (5) Change Order as referred to in GCC Clause 64 shall be serially numbered CO-X-nnn.

Note: (a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home Office	CR-H-nnn
Site	CR-S-nnn

- (b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.



Annex 1. Request for Change Proposal

(Employer's Letterhead)

To:

Date:

Attention:

Contract Name:

Contract Number:

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within _____ days of the date of this letter _____.

1. Title of Change: _____
2. Change Request No. _____
3. Originator of Change: Employer: _____
 Contractor (by Application for Change Proposal No. _____¹⁶:
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
6. Reference drawings and/or technical documents for the request of Change:

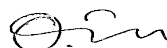
Drawing No./Document No.

Description

7. Detailed conditions or special requirements on the requested Change: _____
8. General Terms and Conditions:

- (a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.
- (b) Your estimate shall include your claim for the additional time, if any, for completion of the requested Change.
- (c) If you have any opinion negative to the adoption of the requested Change in connection with the conformity to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us of your opinion in your proposal of revised provisions.
- (d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.
- (e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

Signature:	<i>[insert signature of authorised representative of the Employer]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
Title of the Signatory:	<i>[insert title of the Signatory]</i>
Name of the Employer:	<i>[insert name of the Employer]</i>


Annex 2. Estimate for Change Proposal

(Contractor's Letterhead)

To:

Date:

Attention:

Contract Name:

Contract Number:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change Proposal in accordance with GCC Sub-Clause 64.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Sub-Clause 64.2.2, is required before estimating the cost for change work.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Brief Description of Change: _____
4. Scheduled Impact of Change: _____
5. Cost for Preparation of Change Proposal: _____¹⁷

(a) Engineering (Amount)

(i)	Engineer	_____ hrs x _____ rate/hr =
(ii)	Draftsperson	_____ hrs x _____ rate/hr =
	Sub-total	_____ hrs

Total Engineering Cost

(b) Other Cost

Total Cost (a) + (b)

Signature:	<i>[insert signature of authorised representative of the Employer]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
Title of the Signatory:	<i>[insert title of the Signatory]</i>
Name of the Employer:	<i>[insert name of the Employer]</i>

¹⁷ Costs shall be in the currencies of the Contract.

Annex 3. Acceptance of Estimate

(Employer's Letterhead)

To:

Date:

Attention:

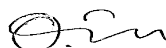
Contract Name:

Contract Number:

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Estimate for Change Proposal No./Rev.: _____
4. Acceptance of Estimate No./Rev.: _____
5. Brief Description of Change: _____
6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparation of Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause 64 of the General Conditions.

Signature:	<i>[insert signature of authorised representative of the Employer]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
Title of the Signatory:	<i>[insert title of the Signatory]</i>
Name of the Employer:	<i>[insert name of the Employer]</i>



Annex 4. Change Proposal

(Contractor's Letterhead)

To:

Date:

Attention:

Contract Name:

Contract Number:

In response to your Request for Change Proposal No. _____, we hereby submit our proposal as follows:

1. Title of Change: _____
2. Change Proposal No./Rev.: _____
3. Originator of Change: Employer: [_____
 Contractor: _____
4. Brief Description of Change: _____
5. Reasons for Change: _____
6. Facilities and/or Item No. of Equipment related to the requested Change:

7. Reference drawings and/or technical documents for the requested Change:

<u>Drawing/Document No.</u>	<u>Description</u>
8. Estimate of increase/decrease to the Contract Price resulting from Change Proposal:¹⁸

(Amount)

- (a) Direct material
- (b) Major construction equipment
- (c) Direct field labor (Total _____ hrs)
- (d) Subcontracts
- (e) Indirect material and labor
- (f) Site supervision
- (g) Head office technical staff salaries

¹⁸ Costs shall be in the currencies of the Contract.

Process engineer	_____ hrs @ _____ rate/hr
Project engineer	_____ hrs @ _____ rate/hr
Equipment engineer	_____ hrs @ _____ rate/hr
Procurement	_____ hrs @ _____ rate/hr
Draftsperson	_____ hrs @ _____ rate/hr
Total	_____ hrs

(h) Extraordinary costs (computer, travel, etc.)

(i) Fee for general administration, _____ % of Items

(j) Taxes and customs duties

Total lump sum cost of Change Proposal
(Sum of items (a) to (j))

Cost to prepare Estimate for Change Proposal
(Amount payable if Change is not accepted)

9. Additional time for Completion required due to Change Proposal

10. Effect on the Functional Guarantees

11. Effect on the other terms and conditions of the Contract

12. Validity of this Proposal: within [Number] days after receipt of this Proposal by the Employer

13. Other terms and conditions of this Change Proposal:

(a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within _____ days from your receipt of this Proposal.

(b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.

(c) Contractor's cost for preparation of this Change Proposal:²

Signature:	<i>[insert signature of authorised representative of the Contractor]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
Title of the Signatory:	<i>[insert title of the Signatory]</i>
Name of the Contractor:	<i>[insert name of the Contractor]</i>

² Specify where necessary.

(Employer's Letterhead)

Date:

Attention:

Contract Number:

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Change Order No./Rev.: _____

4. Originator of Change: Employer: _____
Contractor: _____

5. Authorized Price:

Ref. No.: _____ Date: _____

Foreign currency portion _____ plus Local currency portion _____

6. Adjustment of Time for Completion

None Increase _____ days Decrease _____ days

7. Other effects, if any

Authorized by: _____ Date: _____
(Employer)

Accepted by: _____ Date: _____
(Contractor)

Wali

[Signature]



Annex 6. Pending Agreement Change Order

(Employer's Letterhead)

To:

Date:

Attention:

Contract Name:

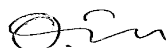
Contract Number:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause 64 of the General Conditions.

1. Title of Change: _____
2. Employer's Request for Change Proposal No./Rev.: _____
dated: _____
3. Contractor's Change Proposal No./Rev.: _____ dated: _____
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
6. Reference Drawings and/or technical documents for the requested Change:

<u>Drawing/Document No.</u>	<u>Description</u>
7. Adjustment of Time for Completion:
8. Other change in the Contract terms:
9. Other terms and conditions:

Signature:	<i>[insert signature of authorised representative of the Employer]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
Title of the Signatory:	<i>[insert title of the Signatory]</i>
Name of the Employer:	<i>[insert name of the Employer]</i>



Annex 7. Application for Change Proposal

(Contractor's Letterhead)

To:

Date:

Attention:

Contract Name:

Contract Number:

We hereby propose that the below-mentioned work be treated as a Change in the Facilities.

1. Title of Change: _____
2. Application for Change Proposal No./Rev.: _____ dated: _____
3. Brief Description of Change: _____
4. Reasons for Change:
5. Order of Magnitude Estimation (in the currencies of the Contract):
6. Scheduled Impact of Change:
7. Effect on Functional Guarantees, if any:
8. Appendix:

Signature:	<i>[insert signature of authorised representative of the Contractor]</i>
Name:	<i>[insert full name of signatory with National ID Number]</i>
Title of the Signatory:	<i>[insert title of the Signatory]</i>
Name of the Contractor:	<i>[insert name of the Contractor]</i>

Signature

Seal

6.6 Supplementary Information

[The Tenderer shall furnish additional description/information covering all activities, if any]



TECHNICAL SPECIFICATIONS Of 33KV AIS SWITCHING SUBSTATION EQUIPMENT

7 TECHNICAL SPECIFICATIONS

7.1 SCOPE

This clause describes the General Technical Requirements for the new 33 KV Circuit Breaker with PCM and general switchyard equipment and shall be read in conjunction with the Project Requirements, Schedules and Drawings in the specification.

The Contractor shall demonstrate that the switchgear has been designed, built and installed in accordance with the relevant international standards and the specification as specified in the tender documents. It shall also operate and perform on a site in accordance with the requirements of the specification and in the environment defined herein.

The design shall be proven by the submission at the time of Tender of test certificates covering all specified tests deemed to be pertinent to the plant and to the conditions in which it will operate or, if such test certificates cannot be supplied or are deemed unacceptable by the Engineer, type tests which will be subject to the conditions of this Contract shall be carried out at no extra cost to the Employer.

The requirement for switchgear spares, tools and appliances, including test, maintenance and handling equipment shall be as stated in the tender document.

7.2 REFERENCES

7.3 BRITISH STANDARDS

Latest standards have to followed

BS	159	Specifications for HV bus bars and bus bar connections
BS	1977	Specifications for high conductivity copper tubes for electrical purposes
BS	2898	Specifications for wrought aluminum for electrical purposes. Strip with drawn or rolled edges.
BS	3938	Specification for current transformers.

BS	5253	Specifications for AC disconnectors and earthing switches.
BS	6651	Lightning Protection
BS	7354	Code of practice for design of HV open terminal stations.

7.4 IEC STANDARDS

Latest standards have to be followed

1	IEC 62271 Series	HV Switchgear and Control gear.
2	IEC 60376	Specification and acceptance of new Sulphur hexafluoride
3	IEC 60480	Guide to checking of Sulphur hexafluoride taken from electrical equipment.
4	IEC 60060	High Voltage test techniques.
5	IEC 60071	Insulation Co-ordination
6	IEC 60099-5	Surge arresters Part 5: Selection and application recommendations
7	IEC 61869-1	Instrument transformers - Part 1: General requirements
8	IEC 61869-2	Current transformers.
9	IEC 61869-3	Voltage transformers.
10	IEC 60273	Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
11	IEC 61850	Communication network and system in substation
12	IEC 60529	Degrees of protection provided by Enclosure (IP code)
13	IEC 60255	Electrical relays
14	IEC 62271-1	High voltage switchgear and control gear: common Specification
15	IEC 62271-100	High voltage switchgear and control gear: Part 100: Alternating current circuit breakers
16	IEC 62271-102	High voltage switchgear and control gear: Part 102: Alternating current disconnectors and earthing switch

7.5 TECHNICAL SPECIFICATIONS of 33 KV VACUUM CIRCUIT BREAKER

1.	Installation	:	Outdoor Sub-station.
2.	Type	:	Vacuum Circuit Breakers
3.	Number of Phase	:	3 (Three)
4.	Operation	:	Single Break in Service/ Pole
5.	Nominal Voltage	:	33 KV
6.	Maximum Operating Voltage	:	36 KV
7.	Frequency	:	50 Hz
8.	Rated Current for	:	1600A
9.	Symmetrical Breaking Capacity	:	1800 MVA
10.	Asymmetry	:	50%
11.	Short Time Current Duration	:	31.5 KA, 3 Sec.

12.	Making Current (Peak) KA	:	80KA
13.	Opening Time (Maximum)	:	0.05 Sec.
14.	Breaking Time	:	≤ 5 Cycle
15.	Capacity of Vacuum Interrupter at rated short circuit current switching	:	≥100 nos. of operations
16.	Basic Insulation Level (1.2/50 Micro Second Wave)	:	170 KV _p
17.	Power Frequency Test Voltage (Dry)		70 KV at 50 Hz, 1 Min.
18.	Rated Operating Sequence	:	0-0.3 Sec – CO – 3 min – CO
19.	Standard	:	Design, Manufacture, Testing, Installation and Performance shall be in accordance with the latest edition of applicable IEC-62271-100
20.	FEATURES		
	-Circuit Breaker terminal connectors shall be suitable for ACSR Merlin, Gross Beak (636MCM) & MARTIN as per GTP. -Grading terminal connector. -All current carrying parts shall be made of copper excluding top & bottom pad/terminals, which shall be copper or aluminum alloy. -Externally visible circuit breaker position indicator. -Electrically remote-controlled operating mechanism. -Shall be capable of the interrupting duties produced by the switching of transformer magnetizing current and the switching of line charging current. Tests certificate demonstrating this ability of the circuit breakers shall be submitted with the offer. -Circuit Breaker closing mechanism shall be 240±10% volt AC motor wound spring-operated type such that the closing speed is independent of the operator. Spring charging motor shall be AC driven Universal motor. Rectifier in motor circuit is not acceptable. -Shall be two tripping coils and one closing coil. Trip coil and close coil shall have freewheeling diode installed. -Hand closing and tripping shall be done through manual levers. -Trip free mechanism as specified in IEC 60056-1 i.e., tripping is independent. -Local “Close” and “Trip” controller. -VCB should be re-strike free. -VCB should be trip free. -Operation Counter. -Supporting Steel Structure. -Bushing Insulator as Specified in IEC-60137. -Weather proof sheet steel control kiosk, with hinged door on three sides and necessary multi-core cable glands. Controls from this position will normally is used under maintenance and emergency conditions only. AC 230V lighting system inside the door of control kiosk shall be provided. -ARC suppression type contacts. -Manually operating devices for slow closing for inspection and maintenance. It shall not be possible to slow close a breaker when in normal services. -Earthing pad with provision for earth leads. -Standard sundries like anti-condensation heaters, MCBS wiring board etc. -Facilities to be incorporate for tripping and lockout of the breaker in the event Vacuum failure falling below stipulated value. -Rating plate and diagram plate shall be made of stainless steel and have engraved		

	letters filled with black enamel paint with clear visibility. -Evidence of prototype tests together with test certificate from an internationally reputed/accredited institution covering the equipment shall be furnished with the offer. The test duty shall be as per the requirements of IEC-60056. -Laminated control & protection drawing set shall be fitted/supplied inside the control box/kiosk. -Motor-driven, spring charged -Automatically charged after each closing operation -O-C-O operation without recharging -Mechanical / electrical interlocking, anti-pumping -Provision for manual charging -Manual closing and tripping arrangement -Mechanical ON-OFF, operation counter and spring-charged indication -All necessary positive interlocks installed, as per IEC guidelines. -33 kV VCB outdoor Panel wiring control cable minimum 1.5 mm² -Spring charging Motor power supply cable minimum 2.5 mm² -At least two auxiliary contact / limit switch contact for VCB spring charging condition control and monitoring. -AT VCB Off condition, Top to middle insulation resistance by injecting 10 kV should be greater than 1 G-ohm. -33 KV VCB built in Outdoor panel should have 3 pin socket line (10A) with switch and MCB for external purpose uses. -For tripping and closing function no interposing auxiliary relay without limit switch should be used. -In the submitted drawing for approval and as built drawing, terminal block description mentioning terminal block type, connection, cable size, cable color, cable route and source and destination will be mentioned.

7.5.1 INFORMATION REQUIRED FOR OUTDOOR TYPE VCB

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information/ Documents have to be submitted: -

- a) The Bidder/ Manufacturer shall submit with the bid the testing procedure & list of testing/measuring equipment, meters etc. along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.
- b) Construction, Installation, Operation & Maintenance Manual.
- c) Outline, Dimensional, Cross-sectional & General arrangement drawings of offered type equipment with mounting structure arrangement.
- d) Manufacturer's printed catalogue describing specification and technical data of the offered type equipment.

7.5.2 TEST REPORTS:

FOR 33KV SWITCHGEAR (OUTDOOR VCB WITH PCM):

Type Test Certificates & Reports for offered type similar or higher Ampere rating Outdoor Vacuum Circuit Breaker for same voltage class from **any short-circuit testing liaison (STL) Member** [http://www.stl-liaison.org/web/03_Members.php] **Testing Organization or Laboratory** as per relevant IEC standard. Testing place must be at STL member organization's own laboratory. If testing place is not at STL member organization's own laboratory, the type test report will not be accepted. If witness/observer from the representative of STL member organization's signs type test report which is tested at non STL laboratory that will also be unacceptable. The type test report along with results shall include **at least** the following tests:

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

7.5.3 APPROVAL OF DRAWINGS FOR OUTDOOR TYPE VCB

Design, drawing diagrams, Specification and Technical Particulars & Guarantees etc., along with Outline, Dimensional, Cross-sectional & General arrangement drawings, Installation diagram, printed catalogue describing the type/ model of offered circuit breaker and vacuum interrupter shall be submitted to the Superintending Engineer, Design & Inspection, NESCO, Rajshahi by the Bidder. The submitted Design, drawing diagrams, Specification and Technical Particulars & Guarantees etc. must be approved by Design & Inspection, NESCO, Rajshahi prior to the manufacturing of the goods.

The Bidder shall have to submit 3 (three) sets of the same for Approval within 15 days from the date of signing Contract. The bidder shall also submit one set reproducible tracing of the above drawings in soft format.

No work shall be performed in connection with the fabrication and manufacture of the Testing Equipment until the technical data and drawings have been approved.

The cost of supplying drawings and specifications shall be borne by the supplier.

7.5.4 TESTS AT MANUFACTURERS WORKS FOR OUTDOOR TYPE VCB

General

Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests.

MATERIAL TESTS

The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

TYPE TEST

Type tests are required to prove the general design of the offered equipment's/ materials. The Tenderer shall submit the type test reports of the offered equipment's/ materials from as per relevant clause.

ROUTINE TESTS

All equipment's/ materials shall be subjected to routine tests as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract at the manufacturers works and shall include, but not be limited to, an operational test.

7.6 TECHNICAL SPECIFICATIONS of 33KV PCM PANEL

7.6.1 GENERAL

The panels shall be vermin and dust proof free standing type completely metal enclosed by sheet steel (minimum 1.62 mm thick) with necessary reinforcement color gray with appropriate spray painting. The approximate dimension of the PCM panel shall be 2100mm (Height) x 600 mm (Width) x 700 mm (Depth) while viewed from the front side, suitable for opening at the back by hinged door with locking arrangement. The panels shall be neatly and completely wired before shipment.

The work relating to protection, control and panels for 33KV Sub-stations shall comprise of development of elementary diagram, design, manufacture, test and supply of pre-wired control panels to be installed in the sub-station control room. The protection, control and panels are to be pre-wired with relays and meters in position. The elementary primary diagram shall be produced giving a clear representation of each protection, control and metering function. The standard design, drawing, manufacturing, testing & performance shall be in accordance to the IEC 62271-200 standards.

7.6.2 A 33 KV PROTECTION, CONTROL, METERING AND RELAY PANEL FOR LINE FEEDER (INCOMING /OUTGOING), EACH COMPRISING:

1.	Indicating analogue/digital Ampere meter flush mounting with dual scales option (0-600A/1200A) for connecting to the current transformer ratio 600-1200/5-5-5A for Line Fedder.	3(three)nos.
2.	Indicating analogue/digital voltmeter with six position selector switch flushmounting with scales 0-40 KV for connection to potential transformer ratio (33/-3)/ (0.11/-3)/(0.11/-3) KV, (50 Hz).	1 (one) set
3.	a) Numerical Programmable Multifunctional type MFM Meter It shall be capable of measuring and displaying MW, MVAR, PF, V, I, f, ϕ etc. distinguishing import and export operation.	1 (one) no.
	b) 3 phases, 4 wire, 3 element solid state, indoor type, multi tariff programmable KWh meter of class of accuracy 0.2S with the features for measuring the parameters viz. phase voltages, phase currents, system frequency, per phase & total KW with demand, KVAR, Power factor etc. The meter should have antenna, modem for communicating with remote server and configuration software (for multi user) with optical probe (one set) must be supplied.	1 (one) no.
4.	Numerical programmable type Three Phase combined IDMT Over Current relay and Earth fault protection relay of 5 Amps, 50 Hz, 110V dc, 3 second operating time ratings having 3 (Three) over current units, one earth fault, over & under voltage, frequency protection & Power measuring option with current setting range of the O/C & E/F relay shall be from 0.1*In to 40*In (where In is relay nominal current) for both overcurrent and earth fault element. All O/C & E/F relays shall have both IDMT & DT (51) and Instantaneous (50) function along with IEC NI, VI, EI, LTI etc. curve setting capability. The relays are housed in a horizontal, flush mounting draw-out case (tropicalized) with self-reset trip relay (relaying 02 nos. NO contacts as spares) (Not to be included in Differential Relay). The numerical programmable relay shall have IEC 61850 communication protocol suitable	1 (one) set

	for SAS implementation. Necessary Binary I/O module along with the relay (alternately separate BCU will also be accepted) shall be provided for SAS/SCADA operation. Along with front side ethernet/USB port, the relay shall also have One Optical ethernet Port and one RJ 45 Port for communication.	
5.	All necessary switches (Local and remote selector switch, TNC switch, etc.), CT, PT test terminal blocks, signaling set lamps, master trip relay, trip circuit supervision relay for each trip coil, PT supervision relay, auxiliary relay, MCB, fuse and provision for lighting etc. terminal blocks, mimic diagram with circuit breaker control indicating switches and isolating position indicating switches, indicating lamps shall be provided to indicate "Spring Charge"/ readiness for closing and healthy trip circuit indicating readiness for tripping. The mimic and positions of circuit breaker control cum position indicating switch and isolator position indicating switch arrangement in the panel. Mimic diagram shall contain LED based Semaphore Indicator for Isolator/Breaker/Earth switch position. The Annunciator shall have 12 windows and have built in buzzer and AC/DC fail relay.	1 (one) set
6.	70 W, 240 V AC, Single Phase heater with thermostat and a visible light indicator which indicate the "ON"- "OFF" position of the heater	1 (one) set

7.6.3 FOR 33 KV PANEL FEATURES:

Each PCM panel shall be equipped with the following:

- a) Instruments and Relays described elsewhere. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station. In addition, numerical relay shall have sufficient contacts and shall be configured for SAS operation. Intermediate auxiliary relay with sufficient spare contacts shall be used for controlling CB or any other switching devices through numerical relay in case of SAS operation.
- b) Status indicating discrepancy, Control switches for 33 kV Circuit Breaker with safety arrangements.
- c) Illuminated Circuit Breaker and Isolator position indicators.
- d) Signaling relays (annunciator, compact type) to yield audiovisual signals on faults and have reset feature.
- e) The inside of the panel will have all auxiliary relays to sense the operation of gas relays, over temperature, over current, differential relay operation failure of auxiliary voltage (DC & AC) etc. and to transmit for tripping and fault signaling.
- f) All inside equipment described and required shall be neatly arranged inside the panel.
- g) Thermostat control heater with status indicating illumination lamp (LED) shall be provided.
- h.) The terminal blocks for connecting the incoming multi-core cables shall be placed at the bottom part and necessary glands/ opening shall be provided for the entry of the outside cables.

- i) Sufficient-working spaces shall be provided inside the panel between instruments and wiring for easy approach.
- j) All AC, DC auxiliary power circuits and PT secondary circuits entering the control panel shall be provided with MCCB. Separate MCBs shall be provided for DC supply to Power, Control and Alarm & Indication circuits.
- k) Provision to hang danger/ caution board.
- l) The PCM panel shall be SCADA/SAS compatible and hence all intelligent devices,digital energy meters etc. shall comply IEC61850. All physical connections for control, measurement and status indication shall be made SAS ready.
- m) Sufficient spare terminals (at least 10%) in each terminal block.
- n) Stabilizing resistance and Metrocil of appropriate value by calculation for the high impedance REF scheme in PCM panel.
- o) There must be two trip coils, both trip coils shall be energized by separate contactsof trip relay for protection tripping. However, for manual tripping, only one trip coil can be engaged only.
- p) All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.
- q) Circuit Breaker control indicating switches and isolating position indicating lamps to indicate spring Charge/ Readiness for closing and healthy trip circuit indicating readiness for tripping.
- r) Signaling /indicating lamps shall be LED type only.
- s) Auxiliary relays, trip relays with spare contacts, fuses.
- t) All necessary switches etc.
- u.) Provision for lighting etc.
- v.) 70W, 230V AC, 1-phase heater with thermostat and control switch and a visible light indicator which indicate the "ON"- "OFF" position of the heater.
- w.) Mimic diagram along with semaphore for CB, DS and ES. Mimic diagram shall contain LED based Semaphore Indicator instead of moving Semaphore indicator. The color and size of the mimic shall be as described below:

33 KV	GREEN	½" X 1/8"
11 KV	BLACK	½" X 1/8"

- x.) Ferrule marking and color coding for all type of wiring shall be as follows:

1. Ferrule marking:

- i. "A"- for differential protection circuit
- ii. "C"- for O/C & E/F protection circuit
- iii. "D"- for metering circuit
- iv. "E"- for PT circuit
- v. "L"- for Alarm & Indication circuit
- vi. "S"- for fault recorder

2. Color coding:

- i. "Black"- for phases of AC supply
- ii. "White"- for neutral of AC supply
- iii. "Grey"- for control circuit
- iv. "Brown & Grey"- for (+) and (-) DC supply respectively
- v. "Red, Yellow, Blue, Black"- for CT and PT circuit
- vi. "Yellow with green strip"- for earthing

- y.) Detailed schematic diagram of control circuit of PCM inside panel.
- z.) Separate relay shall be used for over current, Earth fault protection and differential

protection.

aa.) Annunciator shall have 12 nos. window for incoming and outgoing panel and 24 nos. windows for transformer panel with built in buzzer.

bb.) Necessary communication cable and software shall be supplied.

cc) Inter tripping arrangement for 11 kV incomer (from 33 kV transformer feeder tripping) and for 33 kV transformer feeder (from directional tripping of 11 kV incomer or Stand by E/F tripping) shall be provided. All type of tripping shall be done through Master Trip relay.

dd) Transformer incomer PCM panel shall be equipped with AVR relay and tap changing control switch along with necessary indication system (Tap position, temperature etc.).

ee) Following LED Indicators including Lamp test facility shall be provided in the panel:

								
DC Available	DS close indication	DS open indication	AC Available	CB Open	CB Close	Spring Charged	ES close indication	ES open indication

ff) Relay test plug facility shall be provided in 33 kV PCM panel along with licensed software (CD), communication cable and catalogues etc.

Besides the provisions of control, signal, protection and metering described, any other provisions to suit with the requirement of associated equipment of the concern feeder shall be provided. All meters and relays shall be flush mounting. There shall be panel-grounding terminal.

The bidder shall quote the particulars of various protective relays, meters, Auxiliary relays signaling relays, discrepancy control and position indicating switches etc. of the control panel, mentioning the names of the manufacturers.

7.6.4 ALARMS

The following alarm provision shall be made:

33 kV Incoming/Outgoing Feeder (12 window Annunciator)

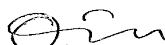
Main DC Fail	AC Fail	Main Relay Faulty	PT Failure
TCS-1 Unhealthy	TCS-2 Unhealthy	O/C Trip	E/F Trip
67 Trip	67N Trip	Spare	Spare

7.6.5 TESTS

Complete tests shall be made at the manufacturer's factory in accordance with the latest relevant IEC 62271-200 standards. Among others, **at least** the following test shall be included:

- Wiring Check
- Functional check
- Di-electric Test
- Verification of protection

Test plugs shall be supplied. Test results of instruments and relays are to be provided along


with the bid.

7.6.6 CONSTRUCTION DETAILS

Each panel shall be fabricated from steel sheet (minimum 1.62 mm thick) with necessary steel member reinforcement to make the structure self-supporting. All joints are to be welded and ground to be made smooth.

Mounting brackets required shall be arranged inside the panel for mounting and fixing auxiliary devices and terminal blocks.

Instruments meters control switches and protective relays shall be mounted on the front panel only. Panel output mounting studs and support brackets shall be accurately located. Finished panel surface shall be free of waves and other imperfections exterior panel surfaces shall be sand blasted, ground smooth, filled, panel and finished with gray enamel. Interior surface shall be sand blasted, primed and finished with glass white enamel.

The panel shall be designed to have bottom closed and with an adequate number of 50mm knock outs provided to facilitate entry of control wires and cables. The back-end closure of the panel shall be equipped with hinged formed door. The door shall be rigid and shall be equipped with three-point latches.

The supplier shall furnish internal panel wiring and circuit protection. The supplier shall provide one 70W, 240, AC strip heater in the panel. The heater shall have a separate switch.

Engraved name plate shall be provided at the top of the front enclosure.

7.6.7 PANEL WIRING

The supplier shall provide internal wiring and connections, in accordance with the requirements of the following paragraph.

All wiring used within the panel shall conform to the requirements of these specifications and shall be installed and tested at the factory. All wiring shall be neatly and carefully installed in wiring gutters of raceway wiring raceway shall be plastic wiring duct with covers. Instrument wiring on the panel shall be numbered sequentially from the sources to the panel instrument and the number of the source equipment shall be used as a prefix for the individual wire numbers, wiring shall be terminated at terminal blocks plainly lettered or marked in accordance with the manufacturer's connection diagrams.

Sufficient clearance shall be provided for all the leads. All the leads for external circuit wiring shall be connected to grounded terminal blocks located for convenient connection of external circuits.

Splices will not be permitted in panel wiring.

All the terminal block connections shall be made with ring type lugs. Pre-insulated ring type terminals with crimp guide or per-insulated slotted spring spade terminals shall be provided on devices equipped with individual fitted covers.

Arrangement of circuits on terminal block shall be such that all the connections for one circuit, plus any spare conductors, shall have terminal blocks adjacent to the split and shall be provided with wiring required to interconnect the split unit.

The size of the wiring used in the panel shall be conform to the following requirements:

- a.) Ampere meter and current transformer circuit: 6 Sq.mm (RYB color code shall be used)
- b.) All other wiring: 2.5 Sq.mm.

Closing circuit of the PCM panel shall have Interlocking mechanism with DS/ES switch.

DC/AC supply of the 33 kV breaker panel shall be supervised through corresponding PCM panel. Single point grounding of the neutral of CT/PT circuits shall be ensured. It is always recommended that the neutral of CT/PT is grounded at the CT/PT junction box end. Ferrule marking and color coding shall be as per clause “7.6.3 33 kV PCM Panel Features”

7.6.8 POWER SUPPLY DISCONNECT

Each panel mounted devices requiring AC or DC supply, shall have disconnecting devices from the power supply in the tripped or open condition.

The MCCB's used in DC control circuit shall have a rating of 6 A and 250 V. The tumbler switch in the heater shall have the same rating.

Each S/S will be equipped generally with the following:

3 (Three) phase MCCB for incoming from Auxiliary transformers - 1 (one) no.

MCCB for incoming DC for battery - 1 (one) no.

MCCB for AC outgoing - 10 (ten) nos.

MCCB for DC outgoing - 10 (ten) nos.

The fuses shall be modular type with Bakelite frame and reinforced retaining clips.

7.6.9 INDICATING LIGHTS

Indicating lights of LED type shall be have transparent glass lenses and appropriately sized register.

7.6.10 TERMINAL BLOCKS

Terminal blocks shall provide with white marking strips, circuit designation by the supplier shall be inscribed on the marking strip with black print, terminals in a quantity of not less than 25 percent of the interconnected terminals in excess shall be provided on each terminal block for circuit modifications and for termination of all conductors in multi-conductor cable.

All CT Terminal blocks shall have shorting, isolating and jacking (test barrel) facility while PT terminal blocks shall have isolating and jacking (test barrel) facility.

CT, PT, Control, Alarm etc. wiring shall be separately grouped or segregated.

All physical connections for control, measurement and status indication shall be made SAS ready hence Terminal Blocks shall be kept reserved if necessary.

Terminal block shall be grouped in each panel for easy accessibility unrestricted by interference from structural members and instruments. Sufficient spaces shall be provided on each side of each terminal block to allow an orderly arrangement of all the lead to be terminated on the block.

7.6.11 INSTRUMENTS AND DEVICES

Indicating instruments shall be semi flush panel type with 1% percent accuracy class except for energy meters which shall be of 0.2. They shall be approximately 100 mm square with black 240 degree scales on a white back ground.

All AC instruments shall be designed for operation on 5A current transformers secondary and 110V (50 Hz) potential transformer secondary.

7.6.12 TRIP RELAYS

Following shall be the main features of a high-speed tripping relays:

All tripping relays shall be of the heavy duty type suitable for panel mounting and shall have operating coils which are rated sufficiently to operate in conjunction with series flag relays. If necessary, normally closed contacts in series with the relay operating coil, shall be delayed for a period which will allow series flag relays to operate satisfactorily. All other tripping contacts

should be instantaneous i.e. no intentional time delay. The operating time shall not exceed 10 milliseconds at rated voltage. The operating range of the relay shall be from 70% to 120% of rated voltage. Electrical reset facilities shall be available for operation, from remote and supervisory controls. High speed tripping relays shall prevent closing of the associated circuit breakers until reset. Wherever the tripping relay contacts need to break the d.c. current, sufficiently rated magnetic blow out contacts or such approved means shall be used.

Trip Relay shall be of following types:

- a. Self-reset type for O/C, E/F protection
- b. Hand & Electrical reset type for Differential, REF and Transformer Self-protection
- c. Operating Coil Voltage: 110 V DC (No series resistor allowed)
- d. Shall have in built freewheeling diode.

7.6.13 SUPERVISION RELAYS

7.6.13.1 TRIP CIRCUIT AND PROTECTION SUPPLY SUPERVISION

The trip circuit supervision function shall be a separate relay and independent of control and protection unit provided in the switchgear. Trip circuit supervision relays shall be provided to monitor each of the trip circuits of all 33kV circuit breakers and each relay shall have sufficient contacts for visual/audible alarm and indication purposes. The trip circuit supervision scheme shall provide continuous supervision of the trip circuits of the circuit breaker in either the open or closed position and independent of local or remote selection at the local operating position. Relay elements shall be delayed on drop-off to prevent false alarms during faults on dc wiring on adjacent circuits, or due to operation of a trip relay contact. Series resistances shall be provided in trip supervision circuits to prevent mal tripping a circuit breaker if a relay element is short circuited. Relay alarm elements shall be equipped with hand resetting flag indicators.

Trip circuit supervision relay (TCSR) shall supervise not only the trip coil but also the whole trip circuit during both breaker open and close position (pre-close & post-close). Both trip circuits shall be supervised by separate TCS relay. TCS function of main relay shall be avoided for supervision.

7.6.13.2 D.C. SUPPLY SUPERVISION

Supervision relays are required for each protection supply, Main protection, Back-up and Trip Relay Reset. Similarly for each trip circuit supply and for each alarm/ indications supply. These supervision relays are to be independent of alarms from the trip circuit supervision scheme so that the operator can clearly differentiate via the available alarms between loss of supply due to a blown fuse / tripped MCB and failure of a trip circuits supervision /faulty supervision wiring.

DC supply supervision shall be performed by the built in AC/DC fail relay of the Annunciator. Hence, the Annunciator shall be powered by dual source (with internal/external AC/DC changeover switch).

7.6.13.3 PT. SUPPLY SUPERVISION

Each PT supply secondary circuit shall be supervised by individual PT supply supervision relay with at least 1NO+1NC. The relay shall detect failure of PT supply and will provide alarm to the respective annunciator for selected PT supply to the panel.

7.6.13.4 PROTECTIVE RELAYS

All Protective relays shall be numerical programmable type and shall comply relevant IEC or equivalent international standard. Contract arrangement of the relays should conform to the requirements of the diagram. All the relays shall be IEC 61850 protocol type for automation network of the 33/11kV Sub-station.

All the protective relays shall be supplied from any of following manufacturers: ABB (Switzerland/Finland/Sweden)/Siemens (Germany/ Switzerland)/Alstom (France/UK)/Schneider (France/UK) /SEL, USA.

Note: Related software with license key & accessories (communication cable and etc.) if required for Relays configuration is within the scope of supply.

7.6.13.5 AUXILIARY RELAY

Auxiliary relays flags type with sufficient contact shall be used for transformer self-protection (OTA, OTT, WTA, WTT, BA, BT, OLTC Surge, PRD for main tank. Breather alarm for OLTC and main tank etc.). Apart from these relays, each 33 kV PCM Cubicle shall be provided with 1 (one) set separate Auxiliary and signaling relay and wiring with fuses. This relay shall be used for control (close & open) & monitoring of CB, DS and ES through numerical relay/BCU in case of SAS operation.

7.6.13.6 ANNUNCIATOR

Each PCM panel shall be equipped with 1 (one) set Annunciator with sufficient windows (LED type with blinking facility) to display the alarms as per requirement. Annunciator shall have built in buzzer and AC/DC fail relay and shall be powered by dual source (with internal/external AC/DC changeover switch). Buttons for Accept, Mute, Test, Reset etc. shall be provided in the Annunciator.

7.6.13.7 INDICATING AMMETERS

Each 33 KV PCM Cubicle will be provided with 3 Ammeters (1 for each phase), digital type.

7.6.13.8 INDICATING VOLTMETERS

1 (one) voltmeter with a multi-selector switch (phase to phase, phase to neutral, off) shall be installed on 33 KV transformer panel.

7.6.13.9 MIMIC BUS

LED based Semaphore Indicator showing the position (open/close) of Circuit Breaker, Isolator and Earth Switch shall be inserted within the mimic bus.

Mimic bus material shall be brass, bronze or copper with enamel finished or anodized aluminum or plastic. The mimic bus and included symbols shall be shaped, colored and located as international standard. Light indicator showing position (opening/closing) of circuit breaker, DS, ES shall be installed.

The mimic bus shall be attached to the panel by mechanical devices, not with adhesive.

Attachment shall be closely spaced to hold all parts of the mimic bus firmly to the panel face.

Mimic bus shall be provided with the following dimensions and color code:

<u>Voltage</u>	<u>Bus Color</u>	<u>Thick</u>	<u>Dimension (mm)</u>
33 KV	Green	3	12

Note: One set of relay testing plug shall be supplied with protection, metering and control

panel which will be included in the quoted price. Each cubicle shall be complete according to the specification, features and bill of materials but not limited to these items; the cubicles should be complete in all respects, to make it fully operational.

7.6.14 INFORMATION REQUIRED

The Bidder/ Manufacturer as per bid requirements shall provide all information. Besides these, the following information/Documents has to be submitted along with the bid:-

- i. Manufacturer's drawing showing Outline dimension & General arrangement drawings of offered type equipment.
- ii. Manufacturer's Printed Catalogue describing specification and technical data of the offered type equipment.
- iii. The Bidder/Manufacturer shall submit with the bid the testing procedure & list of testing/measuring equipment, meters etc. used for Factory test witness.
- iv. Construction, Installation, Operation & Maintenance Manual.
- v. Manufacturer's valid ISO Certificate.
- vi. IEC 61850 Test Certificate for all Protective Relays.

7.6.15 APPROVAL OF DRAWINGS AND SPECIFICATIONS

Design, drawing diagrams, Specification and Technical Particulars & Guarantees etc, along with Outline, Dimensional, Cross-sectional & General arrangement drawings, Installation diagram, printed catalogue describing the type/ model of offered PCM cubicle, Protective relays, Energy meters shall be submitted to the Superintending Engineer, Design & Inspection, NESCO Ltd, Rajshahi by the Bidder. The submitted Design, drawing diagrams, Specification and Technical Particulars & Guarantees etc must be approved by Design & Inspection, NESCO, Rajshahi prior to the manufacturing of the goods.

The Bidder shall have to submit 3 (three) sets of the same for Approval within 15 days from the date of signing Contract. The bidder shall also submit one set reproducible tracing of the above drawings in soft format.

No work shall be performed in connection with the fabrication and manufacture of the Testing Equipment until the technical data and drawings have been approved.

The cost of supplying drawings and specifications shall be borne by the supplier.

7.6.16 TESTS AT MANUFACTURERS WORKS FOR PCM PANEL

General

Functional electrical, material, mechanical and hydraulic tests shall be carried out at manufacturers' premises. The extent and method of recording the results shall be agreed by the Purchaser in ample time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests.

MATERIAL TESTS

The supplier shall provide test pieces free of charge as required to enable the quality of the material to be determined at the supplier's expense. Purchaser may at its own discretion and by specific arrangement accept certified particulars of tests carried out in the absence of his authorized representative.

TYPE TEST



Type tests are required to prove the general design of the offered equipments/ materials. The Bidder shall submit the type test reports of the offered equipments/ materials from as per relevant clause.

ROUTINE TESTS

All equipments/ materials shall be subjected to routine tests as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract at the manufacturers works and shall include, but not be limited to, an operational test.

7.7 SPECIFICATION OF 110V, 3 x 5(6) A, 3-PHASE, 4-WIRE, 3-ELEMENT, INDOOR TYPE MULTI-TARIFF PROGRAMMABLE METER WITH ASSOCIATED INSTRUMENT TRANSFORMERS ENCLOSED IN METERING PANEL.

7.7.1 GENERAL

The meters are required for the purpose of energy metering of medium/high/extra-high voltage consumer metering at 132 kV or 33 kV or 11kV level. KWh is the unit for the purpose.

System voltage Nominal service voltage 110V (PT Secondary), 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.

System frequency 50 Hz

7.7.2 SPECIFICATION OF 110V 3 x 5(6)A, 3-PHASE, 4-WIRE 3-ELEMENT, INDOOR TYPE MULTI TARIFF PROGRAMMABLE DIGITAL ENERGY METER

System voltage	: Nominal service voltage 110V, 3 phase 4 wire, solidly grounded neutral at source, maximum system voltage 120V line to line.
System frequency	: 50 Hz
Standard	: The Energy Meter should be designed, manufactured and tested in accordance with IEC 62052-11, 62053-22 and 62053-23 or ANSI C 12.16, 12.10 (latest publication) or specified in this specification
Installation	: Indoor Type
Type	: Solid state.
Ingress Protection Class	: IP 54 or higher is recommended.
Application	: Registration of KWh (Peak & off-peak), Total KVarh(Q1+Q4), KW on 3- phase, 4-wire supply for balanced & unbalanced load (unidirectional). Peak 17.00-23.00. hrs and off peak 23.00-17.00hrs (programmable) Bangladesh standard time. The software for Time of Use (TOU) shall be so developed to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
Connection	: 3-phase 4-wire, solidly grounded neutral.

Nos. of element	: 3 (Three)
Rated current amps.	: Basic current 5 amps and maximum current 10
Multiplication factor	: The following shall be inscribing on the meter. Dial reading X CT ratio X PT ratio = Actual reading in KWh.
Register	: Solid state LCD display type register. The display shall be programmable, automatic and include: • Meter ID • Time & date • Cumulative KWh (Peak & off-peak) • Cumulative Total KVarh (Q1+Q4) • Maximum demand (KW) with time & date • Cumulative Maximum demand (kW) for billing month. Maximum demand (MD) in kW shall be registered using the technique of cumulating on integration period controlled by built-in process and the MD shall be continuously recorded and the highest shall be indicated. The highest MD shall be added to the cumulative store, which shall be automatically initiated after an interval of one month / one billing period by means of built-in timing device. • Integration period: 30 (thirty) minutes. • Number of MD reset (Automatic & manually). • Average PF for billing period. <u>Instantaneous:</u> • Phase voltage with indication. • Phase amps with direction. • Power factor (average). • Demand (kW). • Voltage angle (each phase). • Current angle (each phase). • Tampering indication in the register. • Power Flow co-ordinate/Sign of power flow direction in the display both for kW & kVar.
Memory storage	: The meter shall have sufficient capacity (minimum 8 MB) to store the following readings and data in non-volatile memory even in case of power failure. • Equipment identification codes, security codes and access codes. • Number of power interruption with date & time (minimum 800 events). • Latest power failure time & date

	• Date & time of meter tempering. (Voltage & Current missing, demand reset, time change). • Event logs • Current & Previous (minimum 48 months) registered in month KWh (Peak & off-peak), Total KVarh (Q1+Q4) • Current & Previous month registered with maximum KW demand since last MD reset with time and date of its occurrence. The meter must have sufficient capacity to store data at 30 (thirty) minutes interval for at least 540 (Five hundred forty) days with 14 channel data recording. ○ Load Profile data [kWh, KVarh (Q1+Q4) ○ Phase voltage or Vh ○ Phase amps or Ah
Accuracy class	: Accuracy class is 0.2 S (point two S)
Number of digit	Minimum 5 (Five) integer with 3 (Three) decimal (Total 8 digit). Type of Display Solid-state LCD display.
Time switch	: The time switch shall be built-in type and shall be designed to perform Voltage phase angle (each phase) or P.F. Angle (each phase) a present cycle of operation. Time switch shall reset MDI at the end of every month (billing period) automatically. In the event of failure of power supply and battery, at the same time set memory shall not be lost i.e. the set program shall be recorded in non-volatile memory. The maximum error shall be kept within 1 (one) second per day. Time error adjustment facility shall be provided.
Battery reserve battery which	: Each time switch must be provided with lithium allow the switch to function for a period of not less than 10 (ten) years. The guaranteed life of the battery should not be less than 10 (ten) years and shall have provision for easy replacement. The shelf life of the battery should be minimum 15 (fifteen) years or more.
Construction	: The meter shall be completely self-containing round socket or enclosure type. The meter cover shall be made of polycarbonate/acrylic /phenolic /resin and socket cover shall be made of metal polycarbonate/ acrylic /phenolic /resin. The meter cover and socket /enclosure shall be provided with security sealing provisions to prevent unauthorized access to the internal meter works and socket /enclosure sealing shall be designed to

accommodate both padlock and wire type seal.

7.7.3 ENCLOSURE FOR IEC STANDARD METER:

IEC meters shall be minimum IP54. The ANSI Standard meter shall be effectively sealed to prevent entrance of rain and dust into its internal parts. The meter shall pass Rain test described in underwriter's laboratory standard UL-50 (USA) for type 3 enclosures. A general-purpose finish of class 1 as specified in section 7 of ANSI C12.10 shall be provided for the meter and it shall meet the requirement of weather simulation test (Sec. 7.2.1 of ANSI C12.10) and salt spray test (ASTM B117). It shall be designed to operate continuously for the normal life of the meter in unsheltered outdoor tropical location exposed to the elements without corrosion or other damage to parts to adversely affect meter accuracy or reliability.

The meter shall be surface mounted in PCM panel with necessary wiring. The enclosure box should be made either of high-quality flame-retardant ABS Resin of minimum 3 mm thickness or of galvanized sheet steel of minimum 1.22 mm (18 SWG) thickness or of auto extinguishable, shockproof and UV resistant, hot molded glass reinforced polyester of minimum 3 mm thickness. The box shall have hinged front door with one toughened glass window or transparent UV resistant Polly carbonate to enable easy reading of meter. The metering box shall be weather proof, dust proof, rodent and insect proof in accordance with enclosure classification IP54. Service cable entry and exit will be sides of the box and 40 (forty) mm diameter hole with black PVC conic cable gland shall be provided for side entry & exit for this purpose. All material parts shall have anti-corrosive protection.

All materials shall be designed, manufactured and tested as per IEC or equivalent international standards except as mentioned. The front door shall be removable and provision must be made for sealing in the closed position.

Socket : Meter sockets shall be suitable for installation of offered type meter.

Meter sockets shall be 3-phase, 4-wire wye, 600-volt class, made from 16-gauge sheet metal. Meter sockets shall be similar except as described below. Meter sockets shall approximately 14" (35.6 cm) H x 9" (22.9 cm) W x 4" (10.2 cm) D and rectangular in shape. Sockets shall be the same size as 1-phase sockets and terminal blocks shall be interchangeable. Sockets shall be ring less type, sealing latch to be stainless steel and have adequate means for socket grounding. Meter socket shall have a 2" (5 cm) Diameter top opening complete with a

1- 1/4" (3.2 cm) hub. Meter socket shall have 4 knockouts with a range up to 2" (5 cm) Diameter, one on the back, one in the bottom and one in each side. Meter socket shall comply with ANSI C 12.6, 12.10

The Socket shall have written permanently (not in paper printed) "connection diagram" distinctly

	marked in addition to all standard data.
Terminal	: Socket connected type/ non-symmetrical, bottom entry, front connection, and connection type with extended terminal cover: Minimum 10 Terminals to accommodate up to 06 sq. mm size of cable. The terminal cover for the offered energy meter shall be extended type, and which can be sealed independently. There shall be free space between bottom of the terminal and the bottom of the terminal cover.
Connection	: 3-phase, 4-wire solidly grounded neutral.
Service life of meter	: Shall be minimum 15 (fifteen) years.
Visual indication of operation:	Pulse indicator on the front of meter as per meter constant.
Special condition	: a) The factory calibration conforms to relevant IEC or equivalent international standard. LCD display shall be shown consecutively and continuously one after another. The display shall be automated i.e. no external means shall be required to see the display. Each display shall last for at least 5 (five) sec. b) Meter Electronic Circuit biasing voltage shall have to be ensured from each phase to phase and each phase to neutral and minimum biasing voltage 40V.
Meter Sealing	: The Energy meter body will be hermetically sealed or ultrasonically welded to avoid unauthorized opening of meter cover.
Communication Port	: The meter must be provided with a suitable communication port to allow downloading of desired information stored in the meter to a PC via hand held data logger as per IEC 1107 or equivalent standard. Relevant all necessary software (for meter programming, configuration, reading, load profile analysis and other communication purpose) with 2 (two) sets of connecting cords (Optical Probe) shall have to be provided during the meter delivery.
Remote Communication	: The meter shall be equipped with external GSM-GPRS Modem/ LTE Modem (LTE Modem preferable), which will be able to interface with RS232/RS485/RJ45/DLMS/COSEM and Modbus or IEC 61850 for data communication with the central server from meters, having all accessories like power supply adapter, necessary connecting cables, antenna with minimum 2.5-3-meter extension cable, connectors, enclosure box with fixing materials etc. The modem shall be compatible with existing AMR system of NESCO.
Software Feature	: The meter shall have the following features in software:

- The whole software should be operative/compatible in windows operating system.
- The software must be able to display and download the recorded instantaneous data from meter such as Programmer ID, Meter ID, kWh (Peak, Off-peak, Total, Export, Import), kVarh, kW, kVar, PF, per phase voltage, per phase current, phase voltage angle, phase current angle. Load profile of minimum 14 (forteen) channels Event & Temper log etc. and as described in Memory Storage section.
- Software should be able to display instantaneous vector diagram/ vector at the time of downloading.
- Meter can be read and write through software with execute option.

Both software and meter should have access code (minimum 3 access level) allocated.

7.7.4 TAMPER AND FRAUD PROTECTION FEATURE:

The meter shall have the following features to prevent/detect tamper and fraud:

- **Phase Sequence Reversal:** The meter should work accurately irrespective of phase sequence of supply.
- **Missing Potentials:** The meter shall be capable of detection occurrence of missing potential of one phase or two phase(s), which can happen due to intentional/accidental disconnection of potential link(s).
- **Terminal cover:** must have micro-switch provision to monitor unauthorized opening. Opening of terminal cover shall trigger an event to be recorded in the event log memory.
- **Software Access:** Software access for configuration and setting of the meters.
- **Strong DC Magnetic Field Detection:** Meter must have Strong DC Magnetic Field Detection feature.
- **Current without Voltage detection:** Meter must have provision to detect current without voltage.

7.7.5 TECHNICAL FEATURE

- The body cover and socket / enclosure shall be provided security sealingprovisions to prevent unauthorized access to the internal meter works.
- The meter shall be provided with connection diagram.
- The data access should be protected by minimum 3(three) steps softwarepassword in meter.
- The meter shall have provision of phase to phase and each phase to neutralbiasing.
- The meter shall have minimum biasing voltage of 40V.
- The meter and socket/enclosure shall have provision of earthing.
- Meter must operate and accurately register demand and energy when servicevoltage is applied across any two of the three input terminals or when servicevoltage is applied from any input terminal to neutral. Meter will continue to operate even the neutral is missing.
- The meter and socket/ enclosure must be the same

country of origin otherwise the bid will be rejected.

- The registration of KWh (Peak & off-peak) on 3-phase, 4-wire supply for balanced & unbalanced load will be unidirectional. i.e. if one, two or three phase supply is/are reversed, it will take the absolute (kWh-del) + absolute (kWh-rev) and will add them together as total 3-phase KWh.
- The meter shall be equipped with remote GSM
- & PSTN communication option.
- It has to be ensured that the meter complies IEC61850 for SAS operation. If required, internal/external module as protocol converter can be used for the compatibility with IEC61850
- The meter shall have permanently print nameplate distinctly marked with the following in addition to all standard data:
 1. The word “NESCO” and insignia of NESCO.
 2. Voltage and current rating.
 3. Frequency.
 4. Number of elements, number of wire and multiplication factor.
 5. Accuracy class.
 6. Year of manufacture.
 7. Serial number.
 8. Name of manufacturer.
 9. Meter constant.

7.7.6 DISPLAY OF MEASURED VALUES/ METER DISPLAY

- The Sequence of LCD display should be user programmable.
- The contrast setting of LCD display should be visible in different lighting environment and distinctly visible in broad daylight.
- The meter should be of displaying time and date, the direction of energy i.e. as import/export or +/-, active tariff and internal fault indicators.
- There should be up to three groups of display to priorities the display. Each showing a programmable function group.
- The meter shall have provision of auto scrolling during absence of power with internal lithium battery backup for at least 3 weeks.
- The four-quadrant diagram (Vector Group) display.

7.7.7 METER PARAMETERIZATION SOFTWARE

- The parameterization software must run on Windows operating environment.
- The software must be protected by software keys to control duplication and installation.
- The software should have a customizable printing feature by task

list.

- The meter must be able to display or record meter ID, Program, Programmer ID, C.T. ratio, V. T. ratio, Total (KWh, KVarh, KVAh, KW, KVar, KVA, P.F); per phase (voltage, current, KW, KVar, KVA, P.F, phase voltage angle, phase current angel); Load profile having minimum 14 (fourteen) Channels data stored in different interval for 540 days.
- Tamper feature: The meter must have Errors & Warnings codes, History log and Eventlog(minimum 800 events) to record date & time of all power outages, demand resets,time change.
- In addition, each software key must bear a unique user ID and that is not transferable to another PC that has different user ID.
- The Meter should be able to display the phasor diagram.
- The software for Time of Use (TOU) shall be compatible to accommodate future tariff and can be customized, if the purchaser changes the tariff. The software shall be compatible with Windows operating system.
- The Meter must be provided with meter passwords to secure communication between meter software and meter having minimum 3(three) access levels.
- The AMR Software have to be compatible with NESCO's existing AMR System. The Tenderer have to develop the total AMR System with exiting and supplied AMR Solution. In this case the tenderer have to provide their meter protocols so that all exiting meters and supplied meters data will be downloaded and managed in a single AMR System.

7.7.8 EXTERNAL MODEM WITH ACCESSORIES

GSM/GPRS modem with RS-232/RS-485 ports, meter interfaced power supply, connection cables, antenna with minimum 2.5 meters cable, mounting facilities, enclosure(if necessary). The modems will be capable of GSM and GPRS connectivity simultaneously. For GSM configuration the AT command will be available and for GPRS communication the APN, reset time, username, password, port number, etc. are configurable. The modem will have the following specification.

Interruption (< 1 ms), RS-232 (at least 1), GPRS class 10, operating band 900/1800, auto reset capability (with phone call, SMS). The modem will be robust, durable and compatible with the employers existing service condition.

7.7.9 MANUFACTURER

All the energy meter shall be supplied from any of the following manufacturers:

- a) Siemens, Germany/Switzerland.
- b) AEG, Germany.
- c) ABB, Switzerland/Finland
- d) Toshiba , Japan
- e) Elster, USA/Romania
- f) Landis Gear, Switzerland.
- g) Honeywell , USA

h) CEWE, Italy

Note: Related software & accessories if required for Energy meters is within the scope of supply.

7.8 TECHNICAL SPECIFICATION OF 33KV 1600A ISOLATOR WITH EARTH BLADE

7.8.1 GENERAL SPECIFICATION:

1.	Installation	Outdoor
2.	Type	Air
3.	Construction	Open
4.	Operation	Gang
5.	Operating Mechanism	Manual
6.	Mounting Position	Vertical/Horizontal on supporting structure.
7.	Number of Pole	3 (Three)
8.	Frequency	50 Hz
9.	System Nominal Voltage	33 KV
10.	System Maximum Voltage	36 KV
11.	Basic Insulation Level	170 KV
12.	Rated continuous Current	1600A
13.	Rated Short Time Withstand Current	31.5 KA (3 Sec.)
14.	Rated 1minute powerfrequency withstand voltage, kV (rms)	70KV
15.	Controlling handle length of Isolator operating Pipe	≥400mm
16.	Isolator electrical operation by motor is preferable with electrical interlock	Yes
17.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of IEC 62271-102 standard & relevant IEC standards.

A. FEATURES

- Single-Break Pattern [Vertical break or Horizontal break], OFF load type.
- Channel type mounting base insulator, blast.
- Coupling tubes for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.
- Auxiliary switch, operated by the phase coupling tube, to control circuits for operating indicators, alarms, electrical inter-locking with the respective breaker to ensure that the isolator can only be operated when the breaker is in "OFF" position etc. with at least 10% spare contacts.
- Terminal connectors shall be suitable for ACSR Merlin/ Grosbeak/MARTIN conductor as required.

- Earthing steel pads with provision for earth lead.
- Glands for multi-core control cables.
- Provision for pad locking in “ON” & “OFF” position.
- Provision of key interlocking.
- Galvanized Nuts, bolts & all accessories for mounting on structures.
- Interlocking magnet for electrical interlocking.
- All ferrous parts shall be hot dipped galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.
- All control devices shall be suitable for operation on 110 V DC supplies from Sub-station.
- Operating mechanism shall be fully tropicalized and housed in waterproof housing.
- Complete supporting steel structure.
- Isolating devices shall be in accordance with IEC 62271-102. They shall be complete with supporting steel work and installed to maintenance of any section of the sub-station plant when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.
- The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 Percent of the specified impulse insulation rating to earth
- Isolating switches shall be designed for life operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer-magnetizing currents. Main contacts shall be of the high-pressure line type and arcing contacts.
- All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator cannot be closed at the same time.
- Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be unaffected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

B. BLADES:

All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except

at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

C. BASE:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

D. SUPPORTING STRUCTURE

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

E. TEST CERTIFICATES:

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

- i. short time & peak withstand current test.
- ii. Resistance measurement test of main circuit.
- iii. Temperature rise test.
- iv. Lightning Impulse Voltage withstand test.
- v. Dielectric test on main circuit & control circuit test.
- vi. Operating and mechanical endurance test.
- vii. Partial discharge test.

F. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard

7.9 TECHNICAL SPECIFICATION OF 33KV 1600A ISOLATOR WITHOUT EARTH BLADE

7.9.1 GENERAL SPECIFICATION:

1.	Installation	Outdoor
2.	Type	Air
3.	Construction	Open
4.	Operation	Gang
5.	Operating Mechanism	Manual
6.	Mounting Position	Vertical on supporting structure.

7.	Number of Pole	3 (Three)
8.	Frequency	50 Hz
9.	System Nominal Voltage	33 KV
10.	System Maximum Voltage	36 KV
11.	Basic Insulation Level	170 KV
12.	Rated continuous Current	1600A
13.	Rated Short Time Withstand Current	31.5 KA (3 Sec.)
14.	Controlling handle length of Isolator operating Pipe	≥400mm
15.	Rated 1minute power frequency withstand voltage, kV (rms)	70KV
16	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of IEC 62271-102 standard & relevant IEC standards.

A. FEATURES

- Single-Break Pattern [Vertical break or Horizontal break (center break)], OFF load type.
- Channel type mounting base insulator, blast.
- Coupling tubes for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.
- Auxiliary switch, operated by the phase coupling tube, to control circuits for operating indicators, alarms, electrical inter-locking with the respective breaker to ensure that the isolator can only be operated when the breaker is in "OFF" position etc. with at least 10% spare contacts.
- Terminal connectors shall be suitable for ACSR Merlin/ Grosbeak/MARTIN conductor as required.
- Earthing steel pads with provision for earth lead.
- Glands for multi-core control cables.
- Provision for pad locking in "ON" & "OFF" position.
- Provision of key interlocking.
- Galvanized Nuts, bolts & all accessories for mounting on structures.
- Interlocking magnet for electrical interlocking.
- All ferrous parts shall be hot dipped galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.
- All control devices shall be suitable for operation on 110 V DC supplies from Sub-station.
- Operating mechanism shall be fully tropicalized and housed in waterproof housing.
- Complete supporting steel structure.
- Isolating devices shall be in accordance with IEC 62271-102. They shall be complete with supporting steel work and installed to maintenance of any section of the sub-station plant when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.
- The air gap between terminals of the same pole with the isolator open shall be

of a length to withstand a minimum impulse voltage wave of 115 Percent of the specified impulse insulation rating to earth

- Isolating switches shall be designed for life operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer-magnetizing currents. Main contacts shall be of the high-pressure line type and arcing contacts.
- All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator cannot be closed at the same time.
- Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be unaffected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

B. BLADES:

All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

C. BASE:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

D. SUPPORTING STRUCTURE

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

E. TEST CERTIFICATES:

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

- i. short time & peak withstand current test.
- ii. Resistance measurement test of main circuit.
- iii. Temperature rise test.
- iv. Lightning Impulse Voltage withstand test.
- v. Dielectric test on main circuit & control circuit test.
- vi. Operating and mechanical endurance test.
- vii. Partial discharge test.

F. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard

7.10 TECHNICAL SPECIFICATION OF 33 KV 400A OFF-LOAD FUSED ISOLATOR FOR BUS PT.

7.10.1 GENERAL:

Installation	Outdoor
Type	Air
Construction	Open
Operation	Gang
Purpose	Bus PT
Operating Mechanism	Manual
Base Mounting Position	Vertical
Number of Pole	3 (Three)
Frequency	50Hz
System Nominal Voltage	33KV
System Maximum Voltage	36KV
Continuous Current	400 A
Fuse Rating	5A
Fuse Type	HRC Cartridge
Rated Short Time Withstand Current	31.5KA 3 Sec.
Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

G. FEATURES

- Single-Break Pattern [Vertical break or Horizontal break], OFF load type.
- Channel type mounting base insulator, blast.
- Coupling tubes for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.
- Auxiliary switch, operated by the phase coupling tube, to control circuits for

operating indicators, alarms, electrical inter-locking with the respective breaker to ensure that the isolator can only be operated when the breaker is in "OFF" position etc. with at least 10% spare contacts.

- Terminal connectors shall be suitable for ACSR Merlin/ Grosbeak/MARTIN conductor as required.
- Earthing steel pads with provision for earth lead.
- Glands for multi-core control cables.
- Provision for pad locking in "ON" & "OFF" position.
- Provision of key interlocking.
- Galvanized Nuts, bolts & all accessories for mounting on structures.
- Interlocking magnet for electrical interlocking.
- All ferrous parts shall be hot dipped galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.
- All control devices shall be suitable for operation on 110 V DC supplies from Sub-station.
- Operating mechanism shall be fully tropicalized and housed in waterproof housing.
- Complete supporting steel structure.
- Isolating devices shall be in accordance with IEC 62271-102. They shall be complete with supporting steel work and installed to maintenance of any section of the sub-station plant when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.
- The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 Percent of the specified impulse insulation rating to earth
- Isolating switches shall be designed for life operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer-magnetizing currents. Main contacts shall be of the high-pressure line type and arcing contacts.
- All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator cannot be closed at the same time.
- Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be unaffected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

H. BLADES:

All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other

corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

I. BASE:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

J. SUPPORTING STRUCTURE

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

K. TEST CERTIFICATES:

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

- i. short time & peak withstand current test.
- ii. Resistance measurement test of main circuit.
- iii. Temperature rise test.
- iv. Lightning Impulse Voltage withstand test.
- v. Dielectric test on main circuit & control circuit test.
- vi. Operating and mechanical endurance test.
- vii. Partial discharge test.

L. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard

7.11 TECHNICAL SPECIFICATION OF 33 KV 2500A OFF-LOAD ISOLATOR WITHOUT EARTH BLADE FOR BUS SECTION.

7.11.1 GENERAL

1.	Installation	Outdoor
2.	Type	Air

3.	Construction	Open
4.	Operation	Gang
5.	Operating Mechanism	Manual
6.	Mounting Position	Vertical for Bus Isolator & Horizontal for Bus Coupler on supporting structure
7.	Number of Pole	3 (Three)
8.	Frequency	50 Hz
9.	System Nominal Voltage	33 KV
10.	System Maximum Voltage	36 KV
11.	Basic Insulation Level	170 KV
12.	Rated continuous Current	2500 A
13.	Rated Short Time Withstand Current	31.5 KA (3 Sec.)
14.	Controlling handle length of Isolator operating Pipe	≥400mm
15.	Rated 1minute frequency withstand voltage, kV (rms)	70KV
16.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of IEC 62271-102 standard & relevant IEC standards.

A. FEATURES

- Single-Break Pattern [Vertical break or Horizontal break], OFF load type.
- Channel type mounting base insulator, blast.
- Coupling tubes for gang operation and adjustable operating rod with insulating link and intermediate guide for operating rod.
- Auxiliary switch, operated by the phase coupling tube, to control circuits for operating indicators, alarms, electrical inter-locking with the respective breaker to ensure that the isolator can only be operated when the breaker is in "OFF" position etc. with at least 10% spare contacts.
- Terminal connectors shall be suitable for ACSR Merlin/ Grosbeak/MARTIN conductor as required.
- Earthing steel pads with provision for earth lead.
- Glands for multi-core control cables.
- Provision for pad locking in "ON" & "OFF" position.
- Provision of key interlocking.
- Galvanized Nuts, bolts & all accessories for mounting on structures.
- Interlocking magnet for electrical interlocking.
- All ferrous parts shall be hot dipped galvanized after completion of machining. Galvanizing shall be in accordance with BS-729 and ASTM A90.
- All control devices shall be suitable for operation on 110 V DC supplies from Sub-station.
- Operating mechanism shall be fully tropicalized and housed in waterproof housing.
- Complete supporting steel structure.
- Isolating devices shall be in accordance with IEC 62271-102. They shall be

complete with supporting steel work and installed to maintenance of any section of the sub-station plant when the remainder is alive and shall be so located that the minimum safety clearances are always maintained.

- The air gap between terminals of the same pole with the isolator open shall be of a length to withstand a minimum impulse voltage wave of 115 Percent of the specified impulse insulation rating to earth
- Isolating switches shall be designed for life operation and isolators shall be hands operated. Where used for feeders they shall be capable of switching transformer-magnetizing currents. Main contacts shall be of the high-pressure line type and arcing contacts.
- All feeder isolators shall be fitted with approved three phase link earthing devices, mechanically, coupled or interlocked with the main isolator so that the earthing device and main isolator cannot be closed at the same time.
- Isolator operating mechanism shall be of robust construction, carefully fitted to ensure free action and shall be unaffected by the climatic conditions at site. Mechanism shall be as simple as possible and comprise a minimum of bearing and wearing parts. Approved grease lubricating devices shall be fitted to all principal bearings. The mechanism shall be housed in weatherproof enclosure complete with auxiliary switches, terminal blocks and cable gland plates. All steel and malleable iron parts including the support steelwork shall be galvanized as per BS-729 and ASTM A90.

B. BLADES:

All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper alloy. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast steel. No grey iron shall be used in the manufacture of any part of the isolator. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

C. BASE:

Each isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure.

D. SUPPORTING STRUCTURE

All isolators and earthing switches shall be rigidly mounted in an upright position on their own supporting structures. Details of the supporting structures shall be furnished by the successful tenderer. The isolators should have requisite fixing details ready for mounting them on switch structures.

E. TEST CERTIFICATES:

Type Test Certificates & Reports for offered type similar or higher Ampere rating Isolator for

same voltage class from **any short-circuit testing liaison (STL) Member** [http://www.stl-liaison.org/web/03_Members.php] **Testing Organization or Laboratory** as per relevant IEC standard otherwise the bid will be rejected. The type test report along with results shall include at least the following tests:

- I. short time & peak withstand current test.
- II. Resistance measurement test of main circuit.
- III. Temperature rise test.
- IV. Lightning Impulse Voltage withstand test.
- V. Dielectric test on main circuit & control circuit test.
- VI. Operating and mechanical endurance test.
- VII. Partial discharge test.

F. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of all type of **33 kV Isolators**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard

7.12 TECHNICAL SPECIFICATIONS of 33KV CURRENT TRANSFORMER

A. GENERAL TECHNICAL PARTICULARS:

1.	Application	Metering and Protection
2.	Installation	Outdoor.
3.	Construction	Sealed Tank
4.	Insulation	Oil
5.	Number of Phase	Single
6.	Rated Frequency	50 Hz
7.	Mounting	On Supporting Structure
8.	System Primary Rated Voltage	33 kV Phase to Phase
9.	Maximum System Voltage	36kV Phase to Phase
10.	System Earthing	Effectively earthed
11.	Basic Insulation Level (1.2/50 μ sec.)	170 kV
12.	Power Frequency Withstand Voltage (1 min. 50 Hz).	70 kV
13.	33 kV Line Feeder Ratio:	600-1200/5-5-5A
14.	Primary	Single Winding
15.	Secondary	Triple Winding
16.	Accuracy Class	0.2s for Measurement, 5P30 for Protection.
17.	Burden	30VA
18.	Short Time Current Rating	31.5 kA for 3 Sec.

19.	Extended Current Rating	120% of Rated Current
20.	Over Current Rating	< 10 A
21.	Creepage Distance	25 mm/ KV (minimum)
22.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the IEC 61869-1, IEC 61869-2 standards and relevant IEC standards.

B. FEATURES & ACCESSORIES:

- i. Current transformer shall have porcelain outdoor type bushing.
- ii. Terminal connectors provided, shall be suitable for ACSR Grosbeak/MARTIN conductor as required.
- iii. The equipment must be tropicalized and suitable for the outdoor location.
- iv. Galvanized nuts, bolts and all accessories required for mounting on structure.
- v. All ferrous parts shall be hot-dip galvanized after completion of machining. Galvanizing shall be in accordance with BS-729.
- vi. Each terminal shall have Hot Dip Galvanized nuts and bolts after fabrication as per BS EN ISO 1461:1999.
- vii. The C.T. secondary terminals shall be brought out in a weatherproof terminal box. The terminal box shall be provided with removable gland plate and gland (s) suitable for 1100 volts grade PVC insulated, PVC sheathed, multicore 6 Sq. mm stranded copper conductor cable.
- viii. The terminal box shall be provided with a door in front 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 rainwater.
- ix. 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.
- x. Diagram plate and rating nameplate shall be provided. Rating plate and diagram plate shall be made of stainless steel and have engraved letters filled with blank enamel paint mentioning manufacturer's name, client name, year of manufacturing, contract no & model no, rating, etc. A schematic drawing indicating the connections shall be provided in the interior of the Terminal box.
- xi. 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 1% 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.
- xii. 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.
- xiii. The primary windings of current transformers shall be constructed of high purity, annealed, high conductivity electrolytic copper and the external primary terminal shall be threads free.
- xiv. 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. The

- rating of the Current Transformer's secondary winding shall be 5 (Five) Amp. The secondary terminals shall be brought out in a compartment for easy access.
- xv. Each core of the Current Transformer shall be of toroidal shape. Core laminations shall be of cold rolled grain-oriented silicon steel or higher grade and 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, cross sectional area, the relevant graphs showing the characteristics of the core material shall be submitted along with the offer.***
 - xvi. 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 color with a smooth surface, arranged to shed away rainwater or condensed water particles (fog.)
 - xvii. 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.
 - xviii. ***Oil level gauge and convenient means of filling, sampling and draining of oil should be provided. 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. An oil drain cock along with a stopcock shall be provided in the bottom flange to permit taking of oil samples for testing, if required.***
 - xix. Metal tank of each Current Transformer shall be provided with two separate earthing terminals for bolted connection to be provided by the purchaser for connection to station earth-mat.
 - xx. Supporting clamps, all accessories shall be provided with the CTs for installation on supporting gantry structure for line feeders CT's.

C. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information.

Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of **33KV Current Transformer**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

A. Type Test For 33kV Outdoor type CT

Type Test Certificates & Reports for offered type similar or higher Ampere rating CT for same voltage class from any **short-circuit testing liaison (STL) Member** [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory as per relevant IEC standards.

- a) Short time current tests
- b) Lightning Impulse withstand Test

- c) High Voltage Power Frequency Withstands Voltage Test
- d) Temperature Rise tests
- e) Wet test for outdoor CT
- f) Determination of errors or other characteristics according to the requirements of the appropriate designation and accuracy class
- g) Instrument Security Factor Test.
- h) Inter Turn Overvoltage Test.

7.13 TECHNICAL SPECIFICATIONS of 33KV POTENTIAL TRANSFORMER

7.13.1 GENERAL TECHNICAL PARTICULARS:

1.	Application	Metering and Protection
2.	Installation	Outdoor
3.	Insulation	Oil
4.	Type	Voltage Induction
5.	Construction	Oil Tank
6.	Number of Phase	Singe Phase (1Set=3Nos)
7.	Frequency	50 Hz
8.	Mounting Mounted	Supporting on Gantry Structure Mounted
9.	System Primary Rated Voltage	33 kV (Phase to Phase)
10.	System Primary Maximum Voltage	36 kV (Phase to Phase)
11.	System Earthlings	Effectively earthed
12.	Basic Insulation (Impulse withstand Voltage)	170 kV
13.	Power Frequency Withstand Voltage	70 kV
14.	The neutral end of primary winding, for direct connection to ground	Insulated to withstand the 10 kV low frequency test.
15.	Type of Secondary Winding	Double Winding
16.	Transformation Ratio	$(33/\sqrt{3}) / (0.11/\sqrt{3}) / (0.11/\sqrt{3})$ kV
17.	Creepage Distance	25 mm/ kV (minimum)
18.	Short Time Current Rating	31.5 kA for 3 Sec.
19.	Rated Secondary Burden	50 VA
20.	Voltage limit factor	1.2 continuous
21.	Class of Accuracy	0.2 for metering and 3P for protection.
22.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance tothe latest editions of the IEC 61869-1, IEC 61869-3 standards and other relevant IEC standards.

A. FEATURES & ACCESSORIES:

- a) Potential transformer shall have porcelain outdoor type bushing.
- b) Terminal connectors provided, shall be suitable for ACSR Merlin/ Grosbeak/ Hawk conductoras required.
- c) The equipment must be tropicalized and suitable for the outdoor location.

- d) Galvanized nuts, bolts and all accessories required for mounting on structure shall be provided.
- e) All ferrous parts shall be hot dip galvanized after completion of machining; galvanizing shall be in accordance with BS-729.
- f) Each terminal shall have cadmium-plated nuts and bolts.
- g) Each Voltage transformer is to be protected by high voltage fuse of the high rupturing capacity cartridge type. All fuses are to be clearly identified and easily accessible.
- h) Diagram plate and rating nameplate shall be provided. Rating plate and diagram plate shall be made of stainless steel and have engraved letters filled with blank enamel paint mentioning manufacturer's name, client name, year of manufacturing, contract no & model no, rating, etc.
- i) Sealing/locking arrangement for the secondary terminal box shall be provided.

B. INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of **33KV Potential Transformer**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.14 TECHNICAL SPECIFICATIONS of 33 KV SINGLE PHASE LIGHTNING ARRESTER

7.14.1 GENERAL:

Lightning arresters shall protect substation and pole-mounted equipment from voltage impulses or surges resulting from lightning strokes, system faults, circuit switching, load rejection or other events. The arresters shall limit such over-voltages to voltage levels below equipment BIL ratings. **The country of origin and place of manufacturer shall be same.**

7.14.2 GENERAL TECHNICAL PARTICULARS:

1	Application	Overhead Line/ Power Cable Line/ Power Transformer of heavy-duty class.
2	Type of Arrester	Station Class, Metal Oxide (ZnO), Gapless
3	Construction	Single Unit, gapless hermetically sealed in with non-linear characteristics with high energy capacity, all enclosed in housing.
4	Installation	Outdoor
5	Mounting	Pole Mounted steel bracket/Gantry mounted
6	Rated Arrester Voltage (rms, Ur)	36kV
7	Continuous Operating Voltage (COV, Uc)	22- 27.5 kV
8	System frequency	50 Hz
9	Number of Phase	1

10.1	Nominal Discharge Current (kAp) of 8/20 micro second wave	10 kA
10.2	Type of Lightning Arrester housing	Polymer (Hydrophobic silicon)
10.3	Power Frequency withstands voltage of Lightning Arrester Housing, Dry & Wet.	≥ 70 kV (Dry & wet)
11	Impulse Withstand Voltage of Lightning Arrester Housing.	≥ 170 kV (peak)
12	Lightning Impulse Residual Voltage (8/20 micro-second wave)	100 or better
13	Steep Current Impulse Residual Voltage at 10kA for 1 micro-second front time.	110 or better
14	High Current Impulse Withstand Value (4/10 micro-second)	100 or better
15	Minimum Energy Discharge capability (kJ/kVr) at rated voltage.	5
16	Line Discharge Class	3
17	Creepage distance (minimum)	31 mm/ kV
18	Leakage current	≤ 1 mA
19	Partial Discharge (pico-coulomb) when energized at 1.05 times its continuous operating voltage.	Not exceeding 10 pC

7.14.3 BASIC FEATURES:

7.14.3.1 CONSTRUCTION:

Lightning arresters shall be gapless type described briefly as follows:

Gap less Arresters shall have elements of zinc oxide to perform both the surge discharge and power frequency reseat functions. ZnO arrester shall have excellent thermal stability for high energy surges, external pollution & temporary over voltage. Zinc oxide elements block RMS value should be minimum 3kV.

7.14.3.2 INSULATORS

The housing insulator of Lightning Arrester shall be Polymer (Hydrophobic silicon). The insulator sheds shall be designed to minimize the trapping of contamination and shall have a high Creepage distance (minimum 31mm/kV) and a high dielectric strength, as specified above. Also, the minimum aerial distance between contact terminals to ground shall be 25 inches (635mm) for 33kV.

7.14.3.3 CONNECTORS

The Line lead and earthing terminal with clamps shall be provided, suitable to accommodate

AAC/ ACSR/ Copper Conductor of diameter from 10.0mm to 15 mm. The necessary connecting wire (5meter for each LA) for the connection of each Lightning arrester to surge counter shall also be included in the scope of supply.

7.14.3.4 NAMEPLATE

Information required for identification must be embossed on a stainless-steel nameplate firmlyfixed to the arrester and shall include:

- a. Designation of arrester (Arrester classification)
- b. Continuous operating voltage
- c. Rated voltage
- d. Nominal discharge current
- e. Rated short-circuit current in kiloamperes (ka).
- f. The manufacturer's name or trade mark, type, model and identification number of the completearrester
- g. Identification of the assembling position of the unit (for multi-unit arresters only)
- h. The year of manufacture
- i. Contract Number.

7.14.3.5 SURGE COUNTER

Tenderer shall supply surge counter/Monitor for each phase of the surge arrester. It shall be integrated into the arrester ground connection and counts the surge arrester responses that have occurred. Surge counter with leakage current meter shall also offer monitoring of arresterleakage current. The surge counter shall be analog or digital type. Surge arrester shall have suitable earth terminal to connect surge counter with insulated cable.

7.14.3.6 MOUNTING:

For pole mounted Mounting steel bracket and fixing bolts, nut, washer, Standard clam etc. shall be provided with the arrester for steel cross-arm. The mounting steel bracket & necessary fittings shall be hot dip galvanized as per BS-729.

7.14.3.7 FEATURES:

- The Arrester shall be Zno type, basically consisting of gapless hermetically sealed in with nonlinear volt-ampere characteristics with high-energy capacity. The Earthing terminal with clamp shall be suitable to accommodate Copper conductor of diameter from 5mm to 10mm.
- Terminal connectors shall be suitable for ACSR Merlin/ Grosbeak conductor as required.
- Zno Arrester with Pressure Relief Device (PRD) shall be of excellent thermal stability for high-energy surges, external pollution & temporary over voltage.
- Leakage Current Detector with Operation counter on each unit shall be provided to indicatenumber of operations on account of lightning of switching surges at man eye height.
- Identification marks on each separately housed unit shall be provided to enable it to be replaced in current position after a multi-unit Arrester has been dismantled.
- All ferrous parts exposed to atmosphere shall be cadmium plated.
- Each Arrester shall have lattice type steel, structures & shall be of sufficient

- high to co- ordinate with the sub-station equipment/material supplied. Each support shall be complete in all respect.
- Arresters with PDR features shall be housed in porcelain containers sealed against the entry of moisture and oxygen and free of influence of moisture and weather condition.
 - Each single pole Arrester shall be furnished with a rating plate; the elements shall also have an individual rating plate. The rating plate shall indicate the main characteristics of the Arrester. The rating plate making shall be in English.
 - The height of the lightning Arresters and supports shall be coordinated with associated substation equipment.
 - The connecting cable (connecting lead) from LA to surge monitor of sufficient length shall be provided and the connecting lead shall be insulated copper cable of minimum 25mm² size.
 - The station class surge arresters shall be complete with fittings suitable for mounting in a vertical position on mild steel channels

7.14.3.8 INFORMATION REQUIRED

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for crucial components of **33KV Lightning Arrester**.
- b) Outline and General Arrangement drawings.
- c) The Bidder/ Manufacturer shall submit the list of available testing/ measuring equipment, meters, etc., along with valid Calibration Certificate(s) from competent authority used in manufacturer's laboratory for performing Routine Test as per IEC standard.

7.14.3.9 TEST REPORTS:

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

- i. Insulation withstand test on the arrester housing.
- ii. Residual voltage test.
 - a. Step current impulse residual voltage test.
 - b. Lightning impulse residual voltage test.
 - c. Switching impulse residual voltage test.
- iii. Long duration current impulse withstand test. iv. Operation duty test.
 - a. High-current impulse operating duty test.
 - b. Switching surge operating duty test.
- v. Short-circuit test.
- vi. Internal partial discharge test.
- vii. Bending moment test.
- viii. Environmental test.
- ix. Seal leak rate test.

x. Radio interference voltage (RIV) test.

7.14.3.10 ROUTINE TEST:

Manufacturer shall have all routine test facilities for arrester at their own manufacturing premises. The following routine tests shall be carried out on all the arresters as per IEC60099-4 and the test reports shall be made available for the observation at the time of inspection

- a) Residual voltage test.
- b) Internal partial discharge test.
- c) Reference voltage test.
- d) Leak test

7.14.3.11 SPECIAL TEST:

Following special tests shall be performed during Pre-Shipment Inspection & Post-Landing Inspection (if necessary).

a. Insulation resistance test: Insulation test result shall be more than $1\text{G}\Omega$

b. Seal Test: The randomly selected samples as specified shall be sunk in the 1 (one) meter deepwater tank for minimum 4 (four) hours. After removing samples from the water tank, the insulation resistance test shall have to perform again. The insulation resistance test result shall not vary more than 10% before and after seal test. After completing this test, the MCOV shall be applied on Arrester at least five times. In each time the result shall be satisfactory as per specification

7.15 TECHNICAL SPECIFICATIONS of 33kV DISC INSULATOR WITH FITTINGS

7.15.1 STANDARDS:

These 33 kV Disc Insulator with Fittings specified in this Section shall conform to the latest edition of the following standards for operation in overhead lines in air under local ambient conditions. Design, Manufacture, Testing and Performance shall be in accordance with latest revisions of BS, IEC standards as listed below or other equivalent internationally acceptable Standards:

IEC-120	:	Ball & Socket Coupling.
IEC-305	:	Characteristics of String Insulator Unit.
IEC-383	:	Insulator Tests.
IEC-437	:	Radio Interference Tests.
IEC-506	:	Switching Impulse Tests.
IEC-575	:	Thermal Mechanical Performance Tests.
BS-137	:	Method of test & requirements.
BS-916	:	Bolts, Screws & Nuts.

7.15.2 SPECIFICATIONS:

A. SPECIFICATION OF DISC INSULATOR:

These 33 kV Disc Insulators shall be designed as per above standards for operation in overhead lines in air under local ambient conditions.

1.	Installation	:	Overhead line for suspension or termination.
2.	Nominal System Voltage, kV	:	33 (line to line).
3.	Type of System	:	Three phase, 50 Hz, Three Wire, Effectively earthed.
4.	Highest System Voltage, kV	:	36 (three phase).
5.	Atmospheric Condition	:	Moderately polluted.
6.	Altitude, meter	:	0-300 above sea level.
7.	Maximum Ambient Temperature, °C	:	45.
8.	Insulator Material	:	The Insulator shall be made of good commercial grade wet process porcelain. The porcelain shall be sound, thoroughly vitrified and free from defects and blemishes that might adversely affect the life of the Insulator. The exposed parts of the porcelain shall be smoothly glazed and shall be brown in color unless otherwise specified.
9.	Type of Insulator	:	Ball & Socket type Disc, security clip made of Stainless Steel or Phosphor Bronze.
10.	Markings	:	Each Insulator shall be marked with the name of Trade Mark of the manufacturer, the type of Insulator and the year of manufacture. These markings shall be legible and indelible.
11.	Maximum Nominal Diameter of Insulator, mm	:	255
12.	Nominal Spacing, mm	:	146
13.	Minimum Nominal Creepage Distance, mm	:	292
14.	Coupling Size, mm	:	16
15.	WITHSTAND VOLTAGE, MINIMUM		
15.1	Power Frequency, dry (one minute), kV		70
15.2	Power Frequency, wet (one minute), kV	:	40
15.3	Impulse 1.2x50 micro-sec wave, kVp		170
16.	FLASHOVER VOLTAGE, MINIMUM		
16.1	Power Frequency, dry, kV	:	78
16.2	Power Frequency, wet, kV		45
16.3	50% Impulse 1.2x50 micro-sec wave,		180

	positive, kVp		
16.4	50% Impulse 1.2x50 micro-sec wave, negative, kVp		185
17.	Power frequency puncture voltage minimum, kv	:	110
18.	Radio-influence voltage data minimum:		
18.1	Power frequency test voltage, rms to ground, kv	:	10
18.2	Maximum riv at 1000 kc micro-volt		50
19.	Mechanical failing load minimum, kn	:	70

B. Specification of 33 kV Strain Insulator String Set:

33 KV Strain Insulator String Set consisting of the following component parts for each set. Design, Manufacture, Testing and Performance shall be in accordance with latest revisions of BS-3288 or other equivalent internationally acceptable Standards.

1.	Anchor Shackle	:	Made of forged steel galvanized complete with cotter bolt and Pin, UTS-6800 Kg, Galvanization as per BS-729 ORASTM A-153 part 1 or ASTM A-153.
2.	Ball Eye	:	Oval eye type, made of forged steel galvanized, UTS- 6800 Kg, Galvanization as per BS- 729 part 1 or ASTM A-153.
3.	Socket Eye	:	Made of malleable iron galvanized complete with cotter bolt and Pin, UTS-6800 Kg, Galvanization as per BS-729part 1 or ASTM A-153.
4.	Strain Clamp	:	Bolted type, made of malleable iron galvanized or Aluminum Alloy, suitable for accommodating ACSR GROSBEAK of overall diameter 25.15 mm or ACSR MERLIN of overall diameter 17.35 mm, complete with bolts, nuts, washers, Aluminum Alloy liner etc., UTS-6800 Kg, Galvanization as per BS- 729 part 1 or ASTM A-153 in case of malleable iron or other ferrous metal.
5.	Disc Insulator	:	4 (Four) Nos. are required for each set.

7.15.3 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- Manufacturer's Printed Catalogue describing specification and technical data for offered Disc insulator.
- Detail dimensional drawings of offered Disc insulators and Disc Fittings.
- Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

7.16 TECHNICAL SPECIFICATIONS of H-TYPE CONNECTORS

7.16.1 STANDARDS:

The H-Type Connectors as specified in this Section shall conform to the latest edition of the following standards for operation in overhead lines in air under local ambient conditions. Design, Manufacture, Testing and Performance of the H-Type Connector shall be in accordance with the BS-3288 Part-1 & BS-4579 Part 3 or equivalent international standards.

7.16.2 SPECIFICATIONS:

The H-Type Connectors will be used for connecting the ACSR Conductors to ACSR Conductors, AAC Conductors to AAC Conductors and Copper Conductors to AAC conductors. These should be Uni-metal or Bi-metal type according to the contractions and applications of such connectors.

These should be made from high conductivity Aluminum and pre-filled with oxide inhabiting compound. The design of the compression type connectors should be such that galvanic corrosion is minimized. Conductor rough & tooling shall be clearly joined on the connectors.

The connector must have at least the same conductance as the conductor for which it is intended to be used and shall carry the full continuous current rating of the conductor size they are designed for.

The original quality of contacts shall be maintained throughout the service life of the connectors. Glow discharge and radio interference must be reduced to a minimum level. All compression type connectors shall be suitable for installation, using either manual or hydraulic compression tools.

The size of the connectors for different Conductors is as follows:

	Grove A		Grove B		Length in mm
	Max (mm ²)	Min (mm ²)	Max (mm ²)	Min (mm ²)	
ACSR GROSBEAK/ACSR GROSBEAK	400	350	400	350	150.00
ACSR MERLIN/ACSR MERLIN	185	150	185	150	112.00
ACSR DOG/ ACSR DOG	120	95	120	95	63.00
AAC WASP/ AAC WASP	120	95	120	95	63.00
AAC ANT/ AAC ANT	70	50	70	50	47.00
AAC WASP / ServiceBail	120	95	35	16	63.00
AAC ANT /Service Bail	70	50	35	16	47.00

7.16.3 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for offered Accessories.
- b) Dimensional drawing of offered Accessories.
- c) Detail description of testing facilities at manufacturer's plant.

7.17 TECHNICAL SPECIFICATIONS OF SHIELD WIRES

1.	Installation	Sub-station
2.	Type	Stranded
3.	Material	High Strength Steel
4.	Nominal Size	9.525 mm
5.	Number of Strand	7 (Seven)
6.	Diameter of Each Strand	3.05 mm
7.	Overall Diameter	9.525 mm
8.	Weight per KM Length	407 Kg
9.	Rated Ultimate Tensile Strength	4,900 Kg/mm ²
10.	Class of Zinc Coating	Class-A
11.	Galvanization	As per BS-729 OR ASTM A-153
12.	Grade of Steel	60,000 Kg
14.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. FEATURES

- Wires shall be shipped on standard non-returnable wooden reels Gross weight shall not exceed 800 Kg per reel. The minimum length of wire per reel shall be 1500 M.
- Each reel shall have the following information stenciled on side size and kind of conductor, length of conductor, gross and net weight. No joints of any kind shall be made in the finished wire entering into the construction of strand.
- The diameter of each zinc coated wire forming the strand shall not differ from the diameter specified by more than plus or minus 0.01 mm.
- The strand shall have a left hand lay with a uniform pitch of not more than 16 times the normal dia. of the strand.

B. PACKING AND SHIPPING

Grounding wire reels shall be constructed sufficiently strong to withstand usual requirements shipping, transporting and field erection.

C. HARDWARE FOR SHIELD WIRE

- i) Angular 90° bolted type T-connector of malleable iron galvanized steel or aluminum alloy suitable for 9.525 mm dia, 7/3.05 mm stranded high strength galvanized steel wire run to 9.525 diameter, 7/3.05 mm stranded high strength galvanized steel wire tap.
- ii) Angular 45° bolted type clamp made of aluminum alloy suitable for 9.525 mm diameter, 7/3.05 mm stranded high strength galvanized steel wire run to 9.525 mm diameter 7/3.05 mm stranded galvanized steel wire tap.
- iii) Shield wire clamp set suitable for 9.525 mm diameter 7/3.05 mm stranded high strength galvanized steel wire, comprising of the followings :
 - a) Bolted wire strain clamp made of malleable iron galvanized steel or aluminum alloy complete with nuts bolts washers etc. anchor shackle made of forged steel galvanized complete with cotter bolt and pins.
 - b) Double eye rectangular made of forged galvanized.
 - c) Wire clip made of malleable iron galvanized or aluminum alloy.

7.18 TECHNICAL SPECIFICATIONS OF PG CLAMP

7.18.1 STANDARDS:

The PG Clamps as specified in this Section shall conform to the latest edition of the following standards for operation in overhead lines in air under local ambient conditions. Design, Manufacture, Testing and Performance of the PG Clamp shall be in accordance with the BS-3288 Part-1 & BS-4579 Part 3 or equivalent international standards.

7.18.2 SPECIFICATIONS:

The PG Clamps will be used for connecting the ACSR Conductors to ACSR Conductors and AAC Conductors to AAC Conductors. Parallel Groove Clamp, a non-tension bolted type connector, shall be made of Aluminum Alloy, massively designed body. The bolts are made of Galvanized Steel. For the insulated conductors, 0.80 mm thick PVC insulation cover is to be provided with full length clamp.

The clamps must have at least the same conductance as the conductor for which it is intended to be used and shall carry the full continuous current rating of the conductor size they are designed for.

	Conductor	Conductor	Dimension	No. of

	Size (sq. mm)	Diameter (mm)	L (mm)	W (mm)	Bolt
ACSR GROSBEAK, either side	370	25.15	125	50	3
ACSR MERLIN, either side	170	17.35	110	45	3
ACSR DOG, either side	100	14.15	95	30	2
ACSR RABBIT, either side	50	10.05	80	22	2
AAC WASP, either side	100	13.17	95	30	2

The original quality of contacts shall be maintained throughout the service life of the clamps. Glowdischarge and radio interference must be reduced to a minimum level.

The size of the connectors for different Clamps is as follows:

7.18.3 Information Required

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- Manufacturer's Printed Catalogue describing specification and technical data for offered Accessories.
- Dimensional drawing of offered Accessories.
- Detail description of testing facilities at manufacturer's plant.

7.19 TECHNICAL SPECIFICATIONS Of SUB STATION STEEL STRUCTURE

7.19.1 GENERAL

The structural steel shall conform to the latest provision of ASTM A36/BS-4360 and all the parts shall be hot dip galvanized as per BS-729 after fabrication.

7.19.2 SCOPE

The work covered by these specifications shall include design, fabrication, marking, painting, galvanizing, supply of all materials, suitable for the location, sea worthy packing, transportation to S/S site, storage on the site, site visit needed to complete the sub-station structures, miscellaneous steel members, nuts, bolts, plates etc. according to specifications and drawings prepared by the bidder and approved by the Purchaser.

7.19.3 DESIGN DATA

Structure shall be designed on the basis of the following:

- Buses, structures, conductors and shield wires shall be designed to withstand the force of a

true wind velocity of 160 KM per hour (120 kg/m^2 on round surface, 200 KG/m^2 on flat surface). The over load capacity factor shall be 2.

- ii) All connections between steel members shall be bolted, minor welds will be allowed for fabrication purposes before galvanization, but no welding will be permitted in the main legs of members of terminal structure. The diagonals and struts shall be bolted directly to the structure legs and to each other. Gasket plates shall not be used unless absolutely necessary.

Members shall be design to avoid depressions that can trap water, such depressions if unavoidable, shall have drain holes, and connections shall be designed so that all bolts can be tightened in the field using a flat erection wrench. The ends of connected members, shall, where necessary, be clipped or cut to allow free movement of the wrench.

The quantity of bolts, nuts and locking devices furnished shall include the number of each size required for erection plus an additional 5% of that number to cover loss and damages.

The bus supports shall be designed to withstand a momentary short circuit current equal to the momentary short circuit rating of the associated breakers.

All shield wires for the sub-station shall be 9.525 mm dia 7 strands with high strength steel galvanized wire.

The contractor must supply complete detailed drawings, bill of materials, composition of materials etc. all connectors, clamps, fittings, hardware, etc. with their range of adjustment. Detailed catalogues, printed literatures etc. showing all significant characteristics for all those things for which the contractor intends to offer must be supplied with the offer. Particular items proposed to be supplied, must be arrow marked in the catalogue.

7.19.4 MATERIAL

All materials used for the sub-station structures and buses shall be new and undamaged and shall conform to the requirements given below certified test reports for all steel materials shall be submitted to the Engineer before such materials shall be fabricated. The latest revisions to the specified American Society for Testing Materials (ASTM) and General Specifications ruling.

i) STEEL STRUCTURE MEMBER

The main steel structure shall be designed for the loading specified and separate additional structures as necessary shall be provided for overhead line terminations, disconnect switches, bus supports, potential devices lightning Arresters and other equipment.

The structures steel shall conform to the latest revision of ASTM for “Steel Bridge and Buildings” or equivalent and all parts shall be hot dip galvanized after packing for fabrication.

All structures shall be shipped completely unassembled unless other-wise specified. All S/S parts shall be plainly marked as aid in assembly and the marking shall agree with the identification on the erection drawings.

The structures shall be completed with all bolts, nuts and locking devices which are required for erection of the structures and for installation of equipment.

ii) CONNECTION FASTENERS

All connections shall be made with hot dip galvanized, sodium carbon, heat treated, regular square head, bolts to meet Feb Spec FF-B-575. Type-1, Grade-5 or of equivalent standard with hot dip galvanized, heavy semi-finished hexagonal nuts. Each fastener shall have a locking device by screw and bolt, length of which shall provide 3mm (minimum) to 12.5 mm (maximum) projection beyond nut when connection is tightened. Standard ASTM-A 394 or equivalent.

iii) WELDING ELECTRODE

Where welding is permitted in Fabrication it shall be done in accordance with ASTM specification A233 using F-70 series low hydrogen electrode as recommended by American Welding Society (AWS) or equivalent for various grades of steel.

iv) GALVANIZED COATING

All angles, channels, plates and other shaped or members required for these structures shall be galvanized in accordance with ASTM specification A123 or equivalent. Galvanizing is to be applied on after fabrication is completed as per BS-729 (1971) Galvanization shall be done when fabrication is complete.

7.19.5 FABRICATION

The Purchaser/ Engineer shall be notified when fabrication of the materials is to begin so that Owner/ Engineer may, if desired, provide shop inspection.

Each steel component shall be completely fabricated and then galvanized in the shop. All workmanship and finishing shall be first class and equal to the best practices in modern steel fabricating shops. All angles and members shall be fabricated in accordance with the standard, specifications and details given in the edition of the "Steel Construction Handbook" issued by the American Institute of Steel Construction or its equivalent. Structural item as delivered to the job site shall have all members straight, free from warp, bends or local deformations, accurate, so that when the structure is assembled, proper fit will be provided. All reaming of holes shall be done at the factory before galvanizing. Punching, drilling or reaming of holes after galvanizing will not be permitted. Holes, 18mm in diameter shall be provided in the steel for ground connection on each leg of each structure. Legs or members shall be drilled with 18 holes at 1.5m intervals, in all of members where ground conductors are to be installed for grounding of shield wires or equipment. These holes shall be made before galvanizing. Holes shall be drilled and attachment devices shall be furnished on the terminal structures for all overhead circuit conductors and shield wires.

The bolt holes shall not exceed the diameter of the bolt by more than 1.5mm. Leg angles and other members shall be lap spliced and the back of the inside angle shall be round to clear the fillet of the outside angles.

i) WELDING

All welding done in the shop on steel members shall be by the shield metal arc processes using joints details performed in accordance with the American Welding Society (AWS) code or equivalent. All welding procedures and operators shall be qualified by an independent testing laboratory in accordance with AWS standard qualification procedures. Accurate records of operator and procedure qualifications shall be maintained by the contractor and shall be available to the owner or Engineer. All welds shall be continuous and shall develop full strength of the least strength component unless otherwise shown on the drawings.

Components shall be thoroughly cleaned before welding and shall be accurately fitted and rightly secured in position during welding and weld surface shall be smooth and uniform and shall be thoroughly cleaned of all slag flux before galvanizing.

ii) MARKING

Each separate structure member shall be plainly stamped with a number. All like parts shall have the same number. The marking shall be stamped into the metal with figures at least 15mm high. Impression shall be made before galvanizing and have sufficient depth so that they are plainly visible after galvanizing. The mark shall be placed as nearly as possible in the same relative position on each piece so as to be seen plainly after assembly of the structure.

The mark numbers shall be composed of letters and numbers that will designate the S/S and type of structure. These markings shall be the same as shown on the fabrication and erection drawings.

iii) GALVANIZING

All steel components of the structures shall be galvanized using the hot dip process. Fabrications shall be completed before galvanizing. All pieces to be galvanized shall be thoroughly cleaned to remove paint, grease, rust, scales or other materials that could interfere with the bonding of zinc with the steel. Galvanization shall be as per BS-729.

The contractor shall perform all works in accordance with the rules and requirements as specified under ASTM specifications A123, A153 and BS-729.

After galvanizing, steel members may be straightened, if necessary, by being re-rolled or pressed only. No punching welding or any other work which may damage the protective cover shall be allowed after galvanizing, except the lapping of nuts. All holes shall be free from peler after galvanizing.

iv) DRAWINGS

The contractor shall furnish to the employer/ engineer complete fabrication and erection drawings along with the strength calculations on buses and loading on each structure foundation of each type of S/S structure for approval before fabrication. Drawings shall show outline, dimensions, drilling and details of fabrications.

7.19.6 STRUCTURE

All structures shall be designed, fabricated, galvanized etc. as specified and as described below:

i) TERMINAL STRUCTURES

The “Terminal Structure” is identified as the structure on which the 33 KV services cable/overhead conductor are terminated. When designed to accept the cable termination, this shall be complete with all plates, bases and other fittings required for mounting the cable and box for 33 KV XLPE single core cable of appropriate size 1x1Cx500 Sq.mm cable per phase) with mounting switches etc.

For overload conductors and shield wires, the maximum tension per conductor shall be 450 Kg.

ii) BUS SUPPORT STRUCTURES

The bus support structures shall be pedestal type, steel columns used to support the strain ACSR S/S buses. These structures shall be designed to withstand the forces outlined herein without damage or deformation. All plates and bus support insulators shall be furnished.

7.19.7 STRUCTURE FOUNDATION

The contractors shall furnish the detail design for foundations of all steel structures considering soil pressure of $<4880 \text{ Kg/m}^2$. A copy of calculations and design criteria for foundation along with complete bill of materials of sand, cement, reinforcing bar and concrete aggregate etc. shall be furnished after signing of the contract and at the time of drawing approval.

7.19.8 PACKING

- i) Steel members shall be shipped unassembled only members with the same mark shall be bundled together.
- ii) All packages shall be securely tied with heavy gauge annealed galvanized steel bands to withstand transportation handling.
- iii) Parts shall be handled and loaded, without damaging the materials or galvanized coatings.
- iv) The contractor shall replace, free of charge all materials which have been damaged due to inadequate or faulty packing.

7.19.9 TAGGING

- i) For erection purpose, each package or bundle shall be tagged to identify the number of pieces.
- ii) For shipping purpose separate tagging shall be used for each package and bundle showing the name and number of the contract, gross weight, port of dispatch and the destination in Bangladesh.

7.20 TECHNICAL SPECIFICATIONS OF BUS-BAR CONDUCTOR AND JUMPERS

1.	Installation	Sub-station, Outdoor.

2.	Type	Aluminum Conductor Steel Reinforced (ACSR)
3.	Code Name	MARTIN ACSR for Bus-Bar GROSBEAK ACSR for Jumpers and dropdown conductor.
4.	Conductor Size	1351.5 MCM for MARTIN ACSR for Single Conductor.636 MCM for Grosbeak (ACSR)
5.	Standard	Performance, design & testing shall be in accordance to the latest editions of ASTM B-232.
6.	Shipment	On standard non-returnable wooden reels Gross weight shall not exceed 2000 Kg per reel.
7.	Standard	Design, Manufacture, Testing, Installation and Performance shall be in accordance to the latest editions of the relevant IEC standards.

A. FEATURES

- Shall be of continuous length between supports.
- Conductors to be used for bus bars shall be stressed not more than 33% of their breaking strength.
- Overhead conductors carried by the S/S structures shall be erected with such a tension that when the conductors are subject to a transverse wind pressure of 640 Pascal's on the whole projected area, the factor of safety is not less than 2 (Two).
- When dissimilar metals are in contact, approved means shall be provided to prevent electrochemical action and corrosion.

7.20.1 ELECTRICAL HARDWARE FOR 33KV SWITCHYARD

- All connectors shall be compression type and made of Aluminum alloy suitable for the conductor. ***(Bidder must submit drawing of all the connectors to be used for this work)***
- If twin conductor is used connector will be also for twin conductor
- Load support clamps shall be complete with bolts, nuts, lock washers etc. complete and of the appropriate size.
- Clamps and fittings made of steel or malleable iron shall be galvanized as per BS-729.
- **Joints and connections shall be such as to permit easy dismantling. All necessary terminals and connections (bi-metallic) shall be provided for connection to the equipment.**
- Suspension and tension conductor clamps shall be as light as possible and shall be of approved type.
- Tension conductor clamps shall be not permit slipping of or damage to or failure of the complete conductor or any part, thereof at a load less than 70% of the breaking load of the conductor.
- Catalogue with making on the catalogues of the hardware proposed shall be submitted with the offer.

7.21 TECHNICAL SPECIFICATIONS Of SUB-STATION EARTHING

A. SCOPE

These Clauses describe the General Requirements for the Earthing and Lightning Protection and shall be read in conjunction with the Project Requirements and Schedules.

B. REFERENCES AMERICAN STANDARDS

ANSI/IEEE STD 80	:	IEEE Guide for Safety in AC Substation Grounding
ANSI/IEEE STD 81	:	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potential of a Grounding System.

7.21.1 German Standards

DIN VDE 0141	:	Earthing Systems for Power Installations with Rated Voltages above 1 KV.

7.21.2 British Standards

BS 1433	:	Specification for copper for electrical purposes; Rod and bars.
BS 2871	:	Specification for copper and copper alloys. Tubes.
BS 2874	:	Specification for copper and copper alloy rods and sections (other than forging stock).
BS 4360	:	Specification for weldable structural steel.
BS 6360	:	Specification for conductors in insulated cables and cords.
BS 6651	:	Protection of Structures against Lightning.
BS 6746	:	Specification for PVC insulation and sheath of electric cables.
BS 7430	:	Code of Practice for Earthing.

7.21.3 International Standards

ISO 427	Wrought copper-tin alloys - chemical composition and forms of wrought productions.
ISO 428	Wrought copper-aluminum alloys - chemical composition and forms of wrought productions.
ISO 11 87	Special wrought copper alloys - chemical composition and forms of wrought products.
ISO 1137	Wrought coppers having minimum copper contents of 99.85% - chemical composition and forms of wrought products.

7.21.4 GENERAL

An earthing System generally in accordance with the requirements of IEEE 80 and BS 7430 shall be designed under this contract. Installation and supply of all materials and equipment also included. The earthing system shall also be including earth electrodes and connections to all electrical equipment and metallic structures on the site. The earth electrodes shall limit the potential rise under fault conditions and buried conductors shall be provided to limit potential differences on the site and adjacent to the site to ensure safety to people and animals. Protection of all electrical equipment against lightning shall also be provided.

7.21.5 EXTENT OF WORK

The work under the clause "SUB-STATION EARTHING" comprises the site testing, design, supply and installation including excavation, back filling and temporary reinforcement of earthing system and connections to electrical apparatus at the substation. Also included the lightning protection scheme and the provision of portable earthing devices.

The contractor shall be required to undertake all necessary earth resistivity tests at the substation sites and from the tests result to undertake the design of the earthing system. The design as well as providing safe passage to earth for the stated earth fault currents, shall also include calculation of step, touch and mesh potentials, which shall be within the allowable limits of the

standards quoted in the specification.

The design calculations of step, touch and mesh potentials accompanied by full installation drawings and material requirement schedules, shall be submitted to and receive the approval of the Engineer before materials procurement or installation commences. **Surfacing materials shall be chosen in accordance with IEEE 80-2013.**

Normally manual calculation is not acceptable. The detail design calculation output through an internationally recognized earthing design software (latest version CYMGRID is recommended by the Employer) shall have to be submitted. The calculation shall be based on 50kg weight, 0.5 second shock duration. The design output shall include the 3D views, contour & profile views of Touch Potential profile, Step Potential Profile, Surface Potential Profile & GPR rise, considering extended size of 5m beyond each side of the proposed mesh area. Contractor shall share Soft copy of design files of the software and seek review and approval from the Employer.

Based on the soil resistivity, fault level & other relevant parameters, the contractor shall design suitable earthing mesh with suitable size & depth of earthing conductor & earthing rod. The cost of such design & implementation shall be deemed to be included in the Contract price.

7.21.6 SOIL SURVEY

The preliminary bid design shall be based on a value of 100 ohm-m soil resistivity. The bidders are requested visit site area and measure site area for bidding purpose if they require.

Not later than one month after the site has been handed over for access, the Contractor shall carry out an earth resistivity survey of the sites and report in writing to the Engineer in accordance with the approved program **with the presence of designated member from related Procurement Division, Design & Inspection Division and Related S&DD. Otherwise, earth resistivity survey report will not be accepted.** The report shall detail the methods and instruments used and the results of the surveys. Based on the results the Contractor shall include in the report his proposal for the resistivities to be used in the design of the earthing system.

The surveys shall show the variation of resistivity across the site and with the depth below the site. The Contractor shall consider if there is a need to model the resistivity in two layers and if there is any advantage in the use of deep rod electrodes.

The surveys shall also determine the depth and nature of any underlying rock, which may limit the depth for driving earth rods or if boring will be necessary for installing earth rods. During the design and installation of the earthing system, the bidder must ensure the inclusion of a minimum of four (04) earth electrodes, each with a depth of 100 meters, positioned at the four corners of the mesh. Additional earth electrodes shall be installed as per the design requirements to achieve the specified earth resistance.

The bidder shall make all necessary arrangements for rig boring, if required, to address soil hardness or the presence of rock layers beneath the surface. The cost of such implementation shall be deemed to be included in the Contract price.

The weather conditions prior to and at the time of the surveys shall be recorded in the report and an assessment made of the seasonal variations in resistivity based on meteorological data for the area. The program for the project should, as far as possible, time the resistivity surveys to take place during a dry season.

The report should also state if there are any indications that the ground is corrosive to bare copper. The report shall be approved by the Engineer before proceeding with the design of the earthing. Test report



format is given below.

Soil Resistivity Test Record Data Sheet					
Date:		Name of Test Place:		Ambient Temperature:	
Test Point	Electrode Spacing (m)	Test Position	Meter Reading (Ω)	Soil Resistivity (Ω -m)	Average Soil Resistivity (Ω -m)
Switchyard	2	North-South			
	4	North-South			
	6	North-South			
	8	North-South			
	10	North-South			
	12	North-South			
	16	North-South			
	18	North-South			
	2	East-West			
	4	East-West			
	6	East-West			
	8	East-West			
	10	East-West			
	12	East-West			
	16	East-West			

7.21.7 FAULT CURRENT AND DURATION

Each site shall be provided with an earth grid of buried conductors designed for an earth fault current of **40 KA for 1(One) second**. The preliminary earthing, design shall be such that the **ground potential rise shall not exceed 4 kV**.

7.21.8 EARTH ELECTRODE SYSTEM DESIGN

(i) Design Calculations

The design of the earth electrode systems shall be based on the approved earth resistivity data and the system fault currents and their duration.

The design calculations in detail shall be submitted for approval of the Engineer and shall be based on the methods given in the standards listed. The calculations shall include the following parameters: -

- earth resistance of the whole system and of its components.
- earth potential rise
- step, touch and mesh potentials inside and outside the perimeter fence
- requirements for a high resistance surface layer
- conductor ratings

Earthing points shall be provided such that the separate resistance of the new earth grid and

all other earthing points does not exceed 0.5 ohm (for calculation) & 0.4 ohm (for practical condition at measuring time) during the dry season.

The earth potential rises shall not exceed the CHIT limits appropriate to the classification of the system unless special precautions are taken to cater for transferred potentials.

Step, touch and mesh potentials shall be within the permitted limits calculated in accordance with the standards given in IEEE 80 for the proposed surface layer.

(ii) Earth Electrode

The earth electrode shall comprise a system of bare copper conductors forming a mesh buried near the surface of the ground and supplemented, if required, by one or more of the following electrodes:-

- a) a system of interconnected rods driven into the ground.
- b) a mesh system of bare conductors buried in the ground.
- c) structural metal work in direct contact with the ground.
- d) reinforcing steel in buried concrete.
- e) a system of bare conductors buried near the surface of the ground outside the perimeter fence.

(iii) Mesh System

The mesh system shall be designed with above to limit touch, step and mesh potentials taking into account the combined length of the mesh conductors, other buried conductors and rods but excluding any buried conductors outside the perimeter fence. Due regard shall be given to nonlinear distribution of the fault current giving rise to the highest potentials at mesh corners. The rating of the mesh conductors shall be compatible with the fault currents after allowing for parallel paths of ***hard drawn high conductivity copper strip with a minimum conductor size of 150 mm².***

The conductor shall be installed in trenches excavated by the contractor at a **minimum depth of 600 mm**. The system will be installed after all foundations have been laid and the site filled to 100 mm below finished level. When the earthing grid has been laid and back filled, bricks will be laid up to finished site level. Where the excavated material is rocky or may be difficult to consolidate, the back filling shall be carried out using other material to the approval of the Engineer. The cost of such material shall be deemed to be included in the Contract.

(iv) Interconnected Rods

If the design calculations show that a mesh alone is unable to limit the required values, then the mesh shall be supplemented by the use of interconnected copper earthing rods driven into the ground or installed in bored holes.

Rods shall be installed inside the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. (The spacing between rods shall not be less than their length, unless rating considerations determine otherwise). The copper rod electrodes of 16 mm diameter shall be interconnected in groups of four to eight rods by insulated copper

conductors and non-ferrous clamps to form a ring. Each group shall be connected to the mesh by duplicate insulated copper conductor via disconnecting test links.

Individual rods may be connected directly to the mesh, provided the rod can be disconnected for testing.

Rods installed in bored holes may be used to reach lower resistivity ground strata at depths beyond the reach of driven rods or where rock is encountered and it is not possible to drive rods. After installing the rod the bored hole shall be back-filled with a low resistivity liquid mixture, which shall not shrink after pouring, to ensure good contact between the rod and the ground for the life of the installation.

The resistance and rating of individual rods and the combined resistance of the groups of rods in the proposed design shall be calculated and the rating of the interconnecting conductors shall not be less than that of the group of rods with a minimum conductor size of 70 mm².

The calculation of potentials in the design of the complete installation shall be made without the group of rods with the lowest estimated resistance to simulate the condition with the group disconnected for testing.

(v) Other Conductors

As an alternative to rods to supplement a mesh, additional bare copper conductors with a cross-section area of not less than 150 mm² may be used. They shall be buried in the ground within the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. Such conductors may be laid below the mesh, below foundations or in areas where there is no plant. It shall be shown by calculation that the step potentials are low in such areas.

The conductor shall be in a ring, or a part of a ring, with at least two widely separated connections to the mesh or other parts of the earthing system.

(vi) Reinforcing Steel

The reinforcing steel in the foundations of buildings containing the primary electrical equipment may be used as auxiliary electrodes, subject to the approval of the Engineer. The contractor shall show in the design calculations that the fault currents and d/c stray currents will not damage the structure.

Steel reinforcing mesh in the floors of the building may also be used for the control of step and touch potentials within the building subject to approval of the Engineer.

(vii) Conductors Outside Perimeter Fence

If the design calculations show that the step and touch potentials outside the perimeter fence or wall exceed the limits, then additional bare conductors shall be buried in the ground outside the fence in the form of rings encircling the whole site.

The distance of the conductors from the fence and the depth shall be determined in the design to ensure that step and touch potentials are within the limits.

The minimum conductor size shall be 75mm² copper and shall be connected to the fence or the mesh with 75mm² conductors at each corner of the site and at intervals of not more than 100m. These conductors shall not be included in the calculations called for above.

(viii) MATERIALS AND INSTALLATION

Description	Size
Mesh Conductor Cross Section Area	185 sq-mm(Min)
Dia & Length of Each electrode/Rod	16 mm & as per Design calculation
Total Length of the electrode & Mesh Conductor	as per Design calculation
Conductor for Neutral of Power Transformer	2x150 sq-mm (Min)

The size/type of earthing Riser/Connectors for different equipment shall be as follows:

1	Neutral of the Power Transformer 33/11kV	-not less than 2x150 mm ² copper conductor with adequate insulation
2	Body of the Power Transformer, 33/11kV	- bare copper bar of not less than 120 mm ² for each power transformer 2 nos.
3	Neutral of the station transformer, 33/0.4 KV	- not less than 150 mm ² copper conductor with adequate insulation
4	Body of the station transformer, 33/0.4 KV	- not less than 120 mm ² Cu wire
5	33 KV PT LV Neutral	- 16 mm ² Cu. Wire.
6	11 KV PT LV Neutral	- 16 mm ² Cu wire
7	Steel mounting structure at the switchyard	- 120 mm ² Cu wire for each steel mounting structure 2 nos.
8	Body of the indoor 33 KV switchgear Panel	- not less than 3x120 mm ² Cu wire
9	Body of the indoor 11 KV switchyard Panel	- not less than 120 mm ² Cu wire at minimum 2points
10	Body of the Indoor control relay panel - 33/11 KV A.C. distribution panel. DC distribution panel, battery charger and other miscellaneous indoor equipment.	- 120 mm ² Cu wire
11	33 KV Lightning Arrestor Outdoor	- not less than 120 mm ² Cu wire at minimum 2points

7.21.9 DESIGN OF EARTH SYSTEM

(i) Earth System

An earth system shall comprise the following components: -

- the conductors between the earth electrode system and the main earthbar
- the main earth bar
- the conductors between the main earth bar and the metallic frames, enclosures or supports of electrical equipment
- the conductors between structural metalwork and non-electrical equipment and the main earth bar

The rating of earth system conductors connected between an item of electrical plant and the earth electrode system shall be sufficient to withstand the fault currents and duration, after allowing for the parallel paths through the earth system conductors, with any one conductor disconnected. The design comprising all the above-mentioned items shall be submitted to the Engineer for approval within four months of the award of contract.

(ii) Connection of the System Neutrals and Earth

The system neutral points within a substation shall be arranged in two groups with a conductor from each group to a test link and there shall be duplicate bare copper conductors of cross-sectional area not less than 150 mm^2 from each test link to the earth grid. The duplicate connection may be in the form of a ring.

Neutral earthing connections between the substation system (transformer) neutral and the test links shall be of bare copper tape, secured and supported on stand-off insulators so that there is no contact between copper tape and transformer tank.

Neutral earthing conductors shall normally be buried directly in the ground but where necessary, they may be cleared to walls, fixed to cable racks or laid in the cable trenches.

(iii) Main Earth Bar

The main copper earth bar shall be in the form of a ring or rings of bare conductors surrounding, or within an area in which items to be earthed are located. Where two or more rings are installed, they shall be interconnected by at least two conductors which shall be widely separated.

The main earth bar, or parts thereof, may also form part of the earth electrode system, providing this is bare conductor.

Each main earth bar shall be connected by at least two widely separated conductors to the earth electrode system.

The minimum conductor size for the main earth and interconnections between earth bars and the earth electrode system shall not be less than 150 mm^2 .

(iv) Electrical Equipment Tank and Structure Connections to Earth

Connections between: (a) all HV electrical equipment and (b) LV electrical equipment comprising substantial multi-cubicle switchboards and the main earth bar shall be duplicated. The bare copper conductor size shall have a minimum cross section area of 150 mm^2 .

All substation equipment, including disconnectors, earth switched, main transformer tanks, current and voltage transformer tanks, switchboards, electrical supporting steelwork and gantries etc. shall all be connected with the earth grid.

Surge Arresters installed for the protection of transformers and reactors shall be connected by

lowreactance paths both to the transformer tanks and to the earth grid.

Capacitor voltage transformers used in connection with line traps shall be connected by direct lowreactance paths to a single earth rod for each Arrester, in addition to the earth grid.

An earth mat shall be installed at all operating positions for outdoor HV equipment manual operating mechanism boxes and local electrical control cubicles to ensure the safety of the operator. The mat shall be directly bonded to the cubicle and the conductors forming the mat and the bonding connections shall have a minimum copper cross-section area of 75 mm².

Galvanized structures comprising bolted lattice components shall not be used as the sole earthconnection path to post and strain insulators or to overhead line earth conductors.

Buildings containing electrical equipment shall be provided, at each level, with a ring of earthing conductors which shall have duplicate connections to the earth grid outside the building. The frames of all switchgear, control and relay panels and other electrical equipment and exposed structural metal work shall be connected by branches to a ring. The ring and branch conductors shall be of the same material as the earth grid. Strip run within buildings, inside cable trenches or above ground level on apparatus shall be neatly supported on non-ferrous clamps.

Fixed earthing connectors for use with portable earthing devices below shall be provided on each bus bar and on both sides of high voltage equipment is by tubular bus bars.

Rigid loops in the copper earthing strip branch bond between the equipment and the earthing grid shall be provided adjacent to each item of high voltage equipment for use with the portable earthing devices. The rigid loops shall be marked green.

Connections between other LV electrical equipment and the earth bar need not be duplicated. The single conductor shall be rated to withstand the fault rating of the equipment.

(v) Connections to Non-Electrical Structural Metalwork and Equipment

All metal work within the project area which does not form part of the electrical equipment shall be bonded to the main earth bar except where otherwise specified. The bonding conductor size shall be not less than 150 mm².

Individual components of metallic structures of plant shall be bonded to adjacent components to form an electrically continuous metallic path to the bonding conductor.

Small electrically isolated metallic components mounted on non-conducting building fabric need not be bonded to the main earth bar.

7.21.10 MATERIALS AND INSTALLATION

(i) Conductors

Conductors shall be of high conductivity copper in the form of circular conductors stranded to IEC228(BS 6360) or solid rods or bars to BS 1433.

Conductor sheaths shall be of PVC to meet the requirements of BS 6746 Grade TM1 or IEC60502 Grade ST1 with a minimum thickness of 1.5mm.

Buried conductors which are not part of the earth electrode system shall be PVC sheathed circular stranded cable.

Bare strip conductors only shall be used for earth electrodes or voltage control meshes.

Conductors buried in the ground shall normally be laid at a depth of 800 mm in an excavated trench. The back fill in the vicinity of the conductor shall be free of stones and the whole back fill shall be well consolidated. Conductors not forming part of a voltage control mesh shall be laid at the depth required by the approved design and in the case of a PVC sheathed conductor, at the same depth as any auxiliary power or control cables following the same route.

All conductors not buried in the ground shall be straightened immediately prior to installation and supported clear of the adjacent surface.

(ii) **Earth Rods**

Earth rods shall be driven to a depth below the ground water table level, to be determined by the Contractor during soil investigation and survey of site.

The earth rods shall be of hard-drawn high conductivity copper with a diameter of not less than 15mm with hardened steel driving caps and tips. The rods should be as long as possible but couplings may be used to obtain the overall depth of driving required by the design.

The rods shall be installed by driving into the ground with a power hammer of suitable design to ensure the minimum of distortion to the rod. Where it is not possible to drive rods to the full depth required due to the presence of a strata of rock, then holes shall be drilled or blasted in the rock. The holes shall be filled with concrete or other approved material prior to inserting the rod.

If difficult driving conditions arising from hard or rocky ground are encountered or are anticipated or there is a need for deep rods, then high tensile steel rods shall be used. High tensile steel rods shall have a molecularly bonded high conductivity copper coating with a minimum radial thickness of not less than 0.25 mm. The overall diameter shall be not less than 12 mm. Rolled external screw threads shall be used on the rod for coupling and after rolling the thickness of the copper coating on the threaded portion shall be not less than 0.05 mm.

Rods, driving caps and tips shall be attached at couplings to ensure that the couplings and screw threads are not subject to driving forces. All screw threads shall be fully shrouded at the couplings. Alternatively, conical couplings may be used to the approval of the Engineer.

High conductivity copper for earth rods shall have a minimum copper content (including silver) of 99.90% to ISO 1337, Cu-ETP or Cu-FRHS (BS 2894 Grade C 101 or C102) for copper earth rods and to ISO 1337 Grade Cu-ETP (BS 28734 Grade C 101) for the molecularly bonded copper coating of steel rods.

The steel for copper-clad steel rods shall be low carbon steel with a tensile strength of not less than 570 N/mm² to ISO 630, Grade Fe 430A (BS 4360 Grade 43A) or better.

Couplings for copper rods shall be of 5% phosphor bronze (copper-tin-phosphorous) to ISO 427, CU Sn₄ (BS 2874, Grade PB 102M) and for copper bonded steel rods of 3% silicon or 7% aluminum bronze to BS 2874, Grade CS 101 and BS 2871, Grade CA 102.

(iii) Fittings

Clips supporting strip conductors not buried in the ground shall be of the direct contact type and clips for circular conductors shall be of the cable saddle type. The clips shall support the conductors clear of the structure.

Conductors shall be connected to earth rods by a bolted clamp to facilitate removal of the conductor for testing rod.

Disconnecting links shall comprise a high conductivity copper link supported on two insulators mounted on a galvanized steel base for bolting to the supporting structure. The two conductors shall be in direct contact with the link and shall not be disturbed by the removal of the link. Links for mounting at ground level shall be mounted on bolts embedded in a concrete base.

Disconnecting links mounted at ground level and the connections at the earth rods shall be enclosed in concrete inspection pits, with concrete lids, installed flush with the ground level.

All conductor fittings shall be manufactured from high strength copper alloys with phosphor bronze nuts, bolts, washers and screws. Binary brass copper alloys will not be acceptable.

All fittings shall be designed for the specific application and shall not be permanently deformed when correctly installed.

Sheathed conductor support fittings may be of silicon aluminum, glass-filled nylon or other tough non-hygroscopic material for indoor installations.

Fittings not in direct contact with bare or sheathed conductors may be of hot-dip galvanized steel. Bi-metallic connectors shall be used between conductors of dissimilar materials and insulating material shall be interposed between metallic fittings and structures of dissimilar materials to prevent corrosion.

(iv) Joints

Permanent joints shall be made by exothermic welding (Cad Welding) below ground, or crimping for above ground connections.

Detachable joints shall be bolted and stranded conductors at bolted joints shall be terminated in exothermic welded lugs or a crimped cable socket. The diameter of any holes drilled in strip conductors shall not greater than half the width of the strip.

Connections to electrical equipment shall be detachable and made at the earthing studs or bolts provided on the equipment by the manufacturer. When an earthing point is not provided, the point and method of connection shall be agreed with the Engineer.

Connections to metallic structures for earthing conductors and bonding conductors between electrically separate parts of a structure shall be either by direct exothermic welding or by



bolting using a stud welded to the structure. Drilling of a structural member for a directly bolted connection shall only be carried out to the approval of the Engineer.

Bolted joints in metallic structures, including pipe work and which do not provide direct metallic contact, shall either be bridged by a bonding conductor or both sides of the joint shall be separately bonded to earth, unless the joint is intended to be an insulated joint for cathodic protection or other purposes.

When the reinforcing in concrete is used as a part of the earthing system, the fittings used to provide a connection point at the surface of the concrete shall be exothermically welded to a reinforcing bar. This fitting shall be provided with a bolted connection for an earthing conductor. The main bars in the reinforcing shall be welded together at intervals to ensure electrical continuity throughout the reinforcing.

No connections shall be made to reinforcing bars and other steelwork which do not form part of the earthing system and are completely encased in concrete.

The Contractor shall provide adequate overhead shielding to effectively prevent direct lightning strikes to any equipment or energized bus within the switchyard areas. The system shall also be designed to provide "effective shielding" to ensure that no insulation flashover can result from atmospheric discharges striking the overhead shielding. The screens shall be of aluminium clad steel wires of not less than 50 sq.mm. total section, and connected to provide low impedance paths to earth.

The lightning protection scheme shall be designed by the Contractor using the latest version of the electro geometric model (EGM) or Rolling sphere method. The substation including building, primary plant and connected infrastructure must be protected against lightning according to IEEE 998 based on the rolling sphere method with effective shielding determined based on the calculated maximum Stroke Current and Strike Distance. Detailed calculations demonstrating the adequacy of the proposed shielding shall be submitted to the Employer for approval prior to the overhead shielding design being finalized.

The layout of the earth wires shall be such that equipment to be protected generally lies within areas bounded by two or more conductors, in which case the protected angle shall not exceed 45°. Where equipment is protected by a single earth wire, the protective angle shall not exceed 35° to the vertical.

The Contractor may propose a lightning mast and shield wire system, however shielding by shield wires is preferred by the Employer. Overhead shield wires shall not make use of "X" patterns & shall not lead to a fault, if broken. Conductor sag shall be considered when designing the overhead shielding system; however, conductor swing need not be considered. The Contractor must provide a formal as built CAD drawing showing the lightning protection coverage plan.

The overhead earth wire shall be suitable for extension to protect the substation equipment to be installed in future stages of development.

7.21.11 EARTHING OF FENCES

I. Method

Metallic fences shall be separately earthed unless they come within 1.8m of any equipment of structure above the surface of the ground and which is connected to the main earthing system. If the separation of 1.8m cannot be obtained, the fence shall be bonded to the main earthing

system.

II. Separately Earthed Fences

The earthing of a fence shall be provided by connecting certain metallic fence posts to an earth rod by a copper conductor. The earth rod shall be driven adjacent to the posts inside the fence line to a depth of not less than 3.0m. where no metallic posts are provided, the earth rods shall be connected directly to the metal wires, mesh or other components of the fence.

If, owing to the nature of the ground, it is not possible to drive earth rods, then fence posts shall be connected to the center point of a 20m length of bare copper conductor buried in the ground at a depth of 500mm, running closely parallel to the inside of the fence.

The earth rods or bare conductor electrodes shall be installed at each corner post, below the outer phase conductors of overhead line connections passing over the fence, at each gate and at intervals of not more than 100m.

III. Bonded Fences

Fences which need to be bonded to the main earthing system of the installation shall be connected by copper conductors to the nearest accessible point on the main earthing system at each point where the fence comes within 1.8 m of any electrical equipment. Bonds shall also be made to each corner post, below the outer phase conductors of overhead line connections passing over the fence at each gate and at intervals of not more than 100m.

IV. Bonding of Fence components

Fences made up of bolted steel or other metallic component do not require bonding between components. Where such fences have non-metallic component, bonds shall be installed to maintain continuity between metallic components. Reinforced concrete components shall be treated as being non-metallic.

Longitudinal wires for supporting other fence component or for anti-climbing guards and the wires of chain link, shall be directly bonded to each electrode or to each bond to the main earthing system.

Metallic component on masonry, brick, concrete or similar boundary wall shall be treated in the same manner as metallic fences.

Wire fence component coated for anticorrosion protection shall be earthed in accordance with this clause.

V. Gates

The fixed metallic components on both sides of the gate shall be directly bonded together by a copper conductor installed under the surface of the access way. Flexible conductors shall be installed to bond the moving parts of the gates to the metallic fixed parts. An earth rod or a bond to the main earthing system shall be installed at each gate.

VI. Potential Control Outside Fences

Where the approved design calculations show that the touch or step potentials outside the fence or boundary wall would otherwise be excessive, bare copper conductors shall be buried in the

ground outside the fence or boundary wall at such depths and spacing as are shown in the approved design calculations to give acceptable touch and step potentials. The conductors shall form complete rings surrounding the installation and each ring shall be bonded to the adjacent ring and to the fence at each corner, below the outer phase conductors of overhead line connections passing over the fence at each gate and at intervals of not more than 100 m. In this case separate earth electrodes are not required for the fences.

If the boundary fence or wall is substantially non-metallic, the rings of conductors shall be bonded to the main earth system at each corner of the site and at intervals of not more than 100m. Any metallic components on such boundary fences or walls shall be bonded to the earthing system in accordance with this Specification.

If the boundary fence is metallic and is not within 1.8 m of any part of the main earthing system or equipment bonded thereto, the fence and outer conductor rings shall but be connected to the main earthing system unless the approved design calculations show otherwise.

Any meshes formed by bonding the outer conductors to the main earthing system shall be subdivided by additional conductors, if required, to give acceptable touch, step and mesh potentials.

VII. Conductors

All conductors used for earthing and bonding the fences and components and for outer rings shall have a cross-sectional area of not less than 70 mm².

VIII. Portable earthing devices

Portable earthing devices for use with outdoor 33 KV apparatus in substations shall be supplied in the numbers stated in Schedule of Technical Requirements and shall comprise:

- (a) Copper alloy earth end clamp for connection to the rigid loops in equipment earth bonding connections.
- (b) Aluminum alloy line and bus bar end clamp to suit the type supplied under the Contract.
- (c) Flexible stranded aluminum alloy conductor with clear protective PVC sheath, size suitable for the specified fault level and duration.
- (d) Telescopic operating pole of glass fibre or similar material, of sufficient length to reach the height of connections to high voltage equipment from ground, but retractable into a carrying length not exceeding 2.5m, and complete with non-slip hand grips.

7.21.12 SUB-STATION EARTHING AND EARTHING ERECTION

General earthing of all equipment shall be in accordance with the IEC recommendation No.80 :1976-Guide for safety in alternating current sub-station Grounding, the British standard code of practice CP-1013: 1965 or other approved standard.

(i) Earthing System

Each site shall be provided with an earth grid of buried copper strip conductors designed for an earth fault current of **40 KA for 1** seconds for all S/S. For the purpose of preliminary design, it shall be assumed that the distribution of the fault current will be such that the ground potential rise of each site will not exceed **4 KV**.

The preliminary design shall be based on clay silt having an assumed resistivity of **100-ohm** meters.

The design of earth grid over the area occupied by switchgear and associated apparatus shall be based on a maximum grid spacing of 5m x 5m. Conductors shall be buried at 800mm depth.

Earthing points will be provided so that the separate resistance of the earth grid and earthing points shall be less than 0.5 ohm (during test) and 0.4(during calculation) under dry climatic conditions. New earth grid has to be connected to old mesh at minimum 6 points.

The operating mechanisms of isolators, earth switches and circuit breaker kiosks not integral with the circuit breaker shall be connected to the earth system by a branch entirely separate from that employed to earth their bases. The branch is to be installed such that the connection would pass beneath where and operator would stand, so as to minimize step potential.

Fences shall be earthed independently of the sub-station grid.

Connections to plant and equipment shall be made using the earthing terminals specified in the contract where a strip has to be drilled to fit an earth terminal the diameter of the hole shall not be greater than ½ the width of the strip.

Joints in earthing strip shall employ chemical welding or high compression joints or clamps.

(ii) Earthing Electrode

Each Earthing point shall consist of a group of copper rods drawn into undisturbed soil to a minimum depth of 4m. Each copper electrode shall be complete with approved nonferrous clamps for the connection of earthing conductors and with a hardened steel tip and cap for driving by means of a power hammer. The number of electrodes per group shall be not less than four and not more than eight, 16mm diameter rods and each copper electrode rod shall be 6-meter length and the number of rod groups per sub-station have been declared in the price schedule.

The electrodes of an earthing point will be arranged in two sub-groups with a conductor from each sub-group to the test link of the earth grid.

In addition to the above a single electrode is to be driven as close as possible and connected to the following:

- i) Three phase set of surge diverters.
- ii) Three phase set of voltage transformers.
- iii) Three phase set of power transformers.
- iv) The fence where an overhead line crosses at gates and at fence corners. The distance between electrodes is not to exceed 50 m.

Separate Earthing Electrode with special earth pit shall be provided for the following two

items:

- (i) Power Transformer neutral earthing (2 Nos.)
- (ii) Lightning Arrester earthing (1 No.)

It has to be ensured that the earthing resistance of these separate earth electrode satisfies the basic requirement of earthing resistance.

(iii) Insulated Earthing Conductors

Conductors for interconnection between the electrodes in any group and between groups and the connections between the link chambers and sub-station earthing main grid shall have twin conductors with a combined rating of 40 KA for one seconds.

Earthing conductors shall be of annealed high conductivity copper and shall be stranded in accordance with IEC-228 table VII class-2. They shall be protected with an extruded PVC sheath of 100 volts grade.

(iv) Sub-station Earthing Screen

Approved earth screens shall be provided to protect the equipment from direct lightning strikes. The screens shall be of the steel corned aluminum wires of not less than 35 Sq.mm total cross section and connected to provide low impedance paths to earth.

The layout of the earth wires shall be such that generally equipment to be protected lie within areas bounded by lines drawn from the earth wire at 35 degree to the vertical in a plane perpendicular to the axes of the earth wire. The earth screen shall be suitable for extension to protect the sub-station equipment to be installed in suitable stages of development.

Connections shall be made of copper strip of 150 Sq.mm cross section between each support for the overhead earthed screen wire and the main sub-station earthing system. Earth wires shall be held in clamps with free pin type joints between clamps and supports connections shall be provided for the terminations of the earth wires of the overhead lines including bimetal connectors where necessary.

The necessary stays, fittings, anchors, flying stays and additional masts shall ensure clearance of not less than 4600 mm over roadways for circuit breaker or transformer removal. The design of all structures shall ensure that in the event of breakage of either one earth wire or one stay wire the factor of safety is not less than 1.5.

7.21.13 REQUIREMENT EARTHING

(i) Low Voltage Switchboards

Earth metal of switchboards fuse and distribution boards and distribution boards shall be bonded together and earthed to the main sub-station earthing system. Earthing connections shall be carried out in bare copper strip having a 3 second rating not less than 31.5 KA for all S/S

(ii) Control Panels

Each control panel shall be provided with a copper earth bar of not less than 80 Sq.mm cross-section and arranged so that the bars of adjacent panels can be joined together to form a common bus. The common earthing bus bar of control and relay panels shall be connected to the main station earthing systems via a copper earthing connection of not less than 80 Sq.mm.

7.22 TECHNICAL SPECIFICATIONS OF 150 MM² PVC COPPER CABLE

7.22.1 GENERAL SPECIFICATION:

These single core cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The maximum acceptable length of cable on a drum shall be 500M and shall be supplied on standard non-returnable treated wooden drum, each drum having stenciled on each side: drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood. Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Conductors shall be circular plain annealed copper in accordance with IEC 60228. Thickness of insulation shall be in accordance with IEC 60502-1. The over sheath shall be an external layer of black PVC.

A means of identifying the cable size and NESCO ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name with year of manufacture and Progressive Meter Marking shall be provided throughout the length of the cable.

Drum wound length of each drum may vary up to $\pm 5\%$ of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

7.22.2 FEATURES AND ACCESSORIES:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminium water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- The PVC covering shall be complete with PVC/A for Insulation and PVC-ST2 for Sheath as per requirement of IEC 60502-1.

- There shall be only one length of conductor on a drum.
- Treated wooden drum standard: AWWA C₁ – 82, C₂ –83, C₁₆ –82, P₅ –83.

7.22.3 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.
- b) Cross-sectional drawings of offered cable.
- c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

7.23 TECHNICAL SPECIFICATIONS OF 95 MM² PVC COPPER CABLE

7.23.1 General Specifications:

These single core cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The maximum acceptable length of cable on a drum shall be 500M and shall be supplied on standard non-returnable treated wooden drum, each drum having stenciled on each side: drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Conductors shall be circular plain annealed copper in accordance with IEC 60228. Thickness of insulation shall be in accordance with IEC 502-1. The over sheath shall be an external layer of black PVC.

A means of identifying the cable size, manufacturer's name, NESCO ownership and year of manufacturing shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name with year of manufacture and Progressive Meter Marking shall be provided throughout the length of the cable.

Drum wound length of each drum may vary up to $\pm 5\%$ of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

7.23.1.1 Features And Accessories:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminium water proof paper

and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.

- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- The PVC covering shall be complete with PVC/A for Insulation and PVC-ST2 for Sheath as per requirement of IEC60502-1.
- There shall be only one length of conductor on a drum.
- Treated wooden drum standard: AWPAC₁ – 82, C₂ –83, C₁₆ –82, P₅ –83.

7.23.1.2 Information Required:

The Bidder/ Manufacturer as per bid requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.
- b) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.

7.24 TECHNICAL SPECIFICATIONS OF COPPER CONTROL CABLE

7.24.1 STANDARDS:

The cable as specified in this Section shall be conforming to the latest edition of the following standards for operation under local ambient conditions. Design, Manufacture, Testing and Performance of the cable shall be in accordance with the IEC 60502-1, BS 6004:1994 or equivalent International standards.

7.24.2 SPECIFICATIONS:

These cables shall be designed as per above standards and suitable for operation at a maximum voltage of 1000V line to line and suitable for use underground buried in earth or in ducts and above ground in air or in buildings under local ambient conditions.

The maximum acceptable length of cable on a drum shall be 1000M and shall be supplied on standard non-returnable treated wooden drum, each drum having stencilled on each side, drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Cable construction shall be as per BS 6004:1994 or equivalent to any internationally acceptable standard. Thickness of PVC insulation shall be in accordance with IEC 60502-1. The over sheath shall be an external layer of black PVC.

Description	Unit	Requirements

Cable Size	mm ²	4CX2.5 mm ²	4CX4mm 2	4CX6mm 2	8CX2.5 mm ²	16CX2.5 mm ²	24CX2.5 mm ²
Material		plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper	plain annealed copper
Numbers & Diameter ofwires	No/m m	7/0.67	7/0.85	7/1.04	7/0.67	7/0.67	7/0.67
Diameter ofSteel wires/Strips	mm	1.4	4×0.8	4×0.8	4x0.8	4x0.8	4x0.8
Thickness of Steel Tape	mm	-	0.25	0.25	0.25	0.25	0.25
Maximum resistance at 30°C	/K M	7.28	3.20	3.20	7.69	7.69	7.69
Nominal thickness of PVC insulation	mm	0.8 (min.)	1.0 (min.)	1.0 (min.)	0.8 (min.)	0.8 (min.)	0.8 (min.)
Nominal thickness ofPVC sheath	mm	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)	1.8 (min.)
Color of Sheath		Black	Black	Black	Black	Black	Black
Approximate outer diameter	mm	17	20	21	20	25	28
Approximate weight	Kg/K M	670	810	920	1040	1630	1730
Continuous permissible service voltage	V	600/1000	600/1000	600/1000	600/1000	600/1000	600/1000

A mean of identifying the cable size and NESCO ownership shall be inscribed throughout the length of the Cable in a single line on the PVC Insulation. The letters shall be upright block characters embossed on the surface; they are being not more than 300 mm between each group. The manufacturer's name shall be provided throughout the length of the cable with year of manufacture.

Drum wound length of each drum may vary up to $\pm 5\%$ of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

7.24.3 FEATURES AND ACCESSORIES:

- Cables shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being

in contact with timber or Aluminium water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.

- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- There shall be only one length of cable on a drum.
- Treated wooden drum standard: AWP A C₁ – 82, C₂ –83, C₁₆ –82, P₅ –83.

7.24.4 INFORMATION REQUIRED:

The Bidder/ Manufacturer as per tender requirements shall provide all information. Besides these, the following information has to be submitted:

- a) Manufacturer's Printed Catalogue describing specification and technical data for offered cable.
- b) Cross-sectional drawings of offered cable.
- c) Detail description of testing facilities (Routine & Type Test) at manufacturer's plant.
- d) Manufacturer's valid ISO 9001 Certificate.

7.25 TECHNICAL SPECIFICATIONS OF ACSR MARTIN

7.25.1 General Specification

This conductor shall be designed as per above standards for operation in overhead lines in air under local ambient conditions. The conductor shall be constructed from hard drawn Aluminium and Zinc Coated Steel wires where the centre wire or wires are of Zinc Coated Steel and the outer layer or layers are of Aluminium. The wires shall be smooth and free from all imperfections not consistent with good commercial practice. No joint of any kind shall be permitted in the Zinc Coated Steel wires.

In all constructions, the successive layers shall have opposite directions of lay, the outermost layer being right-handed. The lay ratio of any Aluminium layer shall not be greater than the lay ratio of Aluminum layer immediately beneath it. The lay ratio of different layers shall be within the limit as per above standards.

The maximum acceptable length of conductor in a drum shall be as stated below and shall be supplied on standard non-returnable treated wooden drum, each drum having stenciled on each side : drum number, code name of conductor, drum wound length together with gross and net weight, the manufacturer's name, the purchaser's name and contract number with date. The cover of the drum should be of same treated wood.

Drum wound length of each drum may vary up to $\pm 5\%$ of the total drum length as tolerance. However, the sum of total drum length shall be as per ordered quantity. Only one short length of conductor on a drum is considered for acceptance, if necessary. For the other requirements, the given data shall be considered as minimum and maximum where necessary. No negative tolerances for the diameter and thickness are acceptable.

ACSR MARTIN

Code name	ACSR MARTIN
Installation	Overhead
Type	Stranded
Material	Hard drawn Aluminum steel reinforced
Overall diameter of the conductor	36.17 mm
Nominal cross sectional area of the conductor	772.10 sq. mm
Number/diameter of Aluminum Strand	54/4.02 mm
Nominal Aluminum cross sectional area	685.40 sq. mm
Number/diameter of Steel Strand	19/2.41 mm
Nominal Steel cross sectional area	86.70 sq. mm
Weight of conductor	2590 Kg/KM
Drum wound length	500 M
Maximum DC Resistance of Conductor at 20 °C	0.0425 Ω /Km
Minimum breaking Load of Conductor	min 11400 Kg
Lay direction for Outermost Layer of Aluminium	Right hand
Rated Strength	Min 206

7.25.2 Features and Accessories:

- Conductors shall be delivered on standard non-returnable strong wooden drum. The central hole of the drum shall be reinforced to fit on axle size 95 mm diameter. The interior of the conductor drum shall be lined with bituminous paper to prevent the conductor from being in contact with timber or Aluminum water proof paper and felt lining shall overlap at seams by at least 20 mm and the seams shall be sealed.
- Drum shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of hoop metal bindings. Conductor drum shall be treated in an approved manner to resist termite and fungus attacks and shall be suitable for outside storage for a minimum period of 3 years in an equatorial climate with out undue deterioration.
- There shall be only one length of conductor on a drum.
- Treated wooden drum standard: AWPAC1 – 82, C2 –83, C16 –82, P5 –83.

7.26 CIVIL AND ARCHITECTURE GENERAL PROVISION FOR AIS SUB-STATION

7.26.1 References

7.26.2 General

The design and construction shall conform to the latest edition of the relevant codes and standards. Any proposed substitution for the listed standards by an equivalent standard will be subject to approval by the Engineer. Relevant standards include.

7.26.3 Design and Construction Standards

BS 12	Portland Cement
BS EN 124	Gully and Manhole tops for vehicular and

pedestrian areas	BS 812	Testing Aggregates
BS 882		Aggregates from natural sources for concrete
BS 1377		Methods of test for soil for civil Engineering purposes
BS 1722:Part10		Anti-intruder fences
BS 1881		Testing concrete
BS 2853		Design and testing of overhead runway beams
BS 3148		Methods of test for water for making concrete
BS 3921		Clay bricks
BS 4449		Steel bars for the reinforcement of concrete
BS 5262		External renderings
BS 5395		Stairs, ladders and walkways
BS 5572		Sanitary pipe works
BS 5628		Code of practice for use of masonry
BS 5930		Code of practice for site investigations
BS 6031		Code of practice for earth works
BS 6367		Code of practice for drainage of roofs and paved areas
BS 6399: Part1		Code of practice for dead and imposed loads
BS 6399: Part 2		Code of practice for wind loads
BS 6465		Sanitary installations
BS 6651		Code of practice for protection of structures against lightning
BS 6700		Design, installation, testing and maintenance of services supplying water for domestic use.
BS 8004		Code of practice for foundations
BS 8005		Sewerage
BS 8100		Lattice towers and masts
BS 8102		Code practice of protection of structures against water the ground structural use of concrete.
BS 8110		Structural use of concrete
BS 820		Lightning of buildings
BS 8215		Code practice for design and installation of damp-proof courses in masonry
BS 8290		Suspended ceilings
Bs 8301		Code of practice for Building drainage

7.26.4 STANDARDS AND CODES OF PRACTICE

The engineering & execution of all Civil, Structural & Architectural works shall be based on the latest edition or revision of the applicable portion of the following Codes and Specifications. In case any particular aspect of work is not covered by these Standards, other standard specifications, as may be specified by the Engineer, shall be followed.

- a) The Bureau of British Standard Codes.
- b) Bangladesh National Building Code

- c) Environmental protection agency
- d) American Codes and standards (ASTM, ACI, AASHTO, AASHO)
- e) Local Statutory regulations
- f) Rules & Regulations of local authorities

The Civil Works shall be designed and constructed in accordance with the Specifications, relevant Standards and Codes of Practice approved by the Engineer. Local code of practice shall be followed where not mentioned. The Contractor shall submit together with his bid a schedule of standards and codes of practice to be followed in the design and construction of the Works. Copies of these codes and standards shall be made available to the Engineer during the design and construction period. In the case of the Standards and Codes not published in English, the Contractor shall obtain English translations when required and send them to the Engineer.

The Contractor shall be responsible for the establishment of design parameters to satisfy the requirement of the project.

Basic design conditions shall be as follows: -

- a. Seismic coefficient at Ground

Level (Horizontal) (PGA) : Seismic Zone-1, Zone coefficient, $Z=0.12$
(as per BNBC, 2015).

- b. Design Storm : Based on frequency-intensity Duration curves
prepared for Rajshahi Zone
- c. Wind velocity : 177.12 km/hr
- d. Design load for road : H-20-S16-44 (AASHO)
- e. Standards and codes of practice : ASTM, ACI, BNBC and international codes of practice and other Standards to be approved by the Engineer

7.26.5 Design

Both Architectural and Structural Design shall be submitted by the contractor to the employer for approval.

7.26.6 Architectural and structural Requirements of Buildings

The details Architectural, Structural & other related drawing and design with Green Building concept shall be submitted by the contractor to employer for approval.

1. **Structure** : Modern Architectural designed R.C.C or Steel Framed Structure featured by Green Building Technology.

2. **Partition Wall:**

- For all Exterior wall thickness should be 10 (ten) inches and interior wall thickness should be 5 (five) inches and to be used 1st Class Bricks.
- All Brick wall should be plastered both sides as per standard (Except where Face-Facing Treatment to be used)
- In case of R.C.C. works 20mm down graded Stone chips should be used.

3. **Covered Area** : Minimum required area in Building are included with service areas & Other

Specific Functions - Control Room, Battery room, Cable Trench, Store, Office Rooms, walkway, open Space & stair case etc.

4. **Foundation** : Considering 02 storied building (no Basement) (G+1) with three storied foundation

- Plinth Level at +3ft above from Ground Level
- Ground Floor clear height 9'-6" ft Cable Trench & Ancillary Facility
- 1st Floor clear height 13'-6" ft for Control room

5. **Floor/Roof Finish** :

- To be used 24 inch x 24 inch size European standard Mirror Polished Homogeneous tiles for 1st Floor.
- Standard Quality Tiles for walk way or other common space.

6. **Toilet/ Sanitary:**

- Floor and full height wall of the Toilet should be furnished by European Standard Tiles (tiles type & quality is subject to approval of NESCO Engineer) with decorative boarder. **Floor tiles should be non-slippery.** The floor of the toilet should have adequate slope so that water doesn't get clogged on the floor.
- To be used European Standard Commode, Basin and others Sanitary Fittings & Fixtures (such as Pillar Cock, Bib Cock, Push Shower etc.) should be European Standard as well as **approved sample and design.**
- To be Constructed 10 users septic tank, inspection pit, sewerage line, apron, drain etc.
- To be provided water supply system with Deep Tube well & over head water tank.

7. **Electrical Fittings & Fixture :**

- Concealed Electrical wiring by Eastern/BRB/Paradise Fire Resistant Cable
- European Made MK type Gang switch, socket MCBetc
- Provision for Internet facilities system, Dish Line, Telephone & Intercom wiring.
- Sufficient Earthing facilities.
- To be used LED Light
- To be provided sufficient Air Conditioner
- To be provided sufficient Ceiling Fan

8. **Interior Wall Finishing:** Smooth Finished & soft colored Plastic paint should be used over the Plastering work of interior wall and ceiling.

9. **Exterior Wall:** Smooth Finished & Architectural approved colored weather coat wall. Some should be used over the Plastering work of Exterior where should be used Ceramic Facing brick / Rustic Tiles.

10. **Window:** Window should be made Standard Quality Thai Aluminum frame and minimum 5mm thickness glass using U.S (AAMA) Standard.

11. **Door:** Door Frame and Shutter should be made by solid wood such as Burma Teak, Teak Chambal, Chapalish etc. which shall be **approved by the owner's engineer.**

12. **Stair Railing:** Should be used approved designed SS Railing in the Stair case.

13. **Sign, Signal & Annotation :**

- Integrated Design of Different kind of Indicators like- Acrylic Sign Board, LED Sign Board, Neon Sign Board, Reception Sign Board, Safety Sign, PVC Letters, Glow Sign Board, Customized Display Boards, Overhead , Metal Nameplates, Commercial Sign Boards, Outdoor Signs, Electronic Sign Boards etc. should be provided in the design & construction.
- Digital LED Signboard with the features of- Excellent visibility (even in daylight); Good quality at reasonable price and light weight; Simple installation, Safe to touch and clean; Changing color for attracting attention; Extremely low power consumption.
- Should be provided the Accessories like Adaptor and chains etc.

14. **Approval & Test:**

The set of plans, designs and specification of a building have to be submitted to the Authority as per provision of this Code and duly approved and sanctioned by the Authority. Materials & Item (if required) should be tested from any authorized Institutions of Bangladesh furnished by the Contractor.

The columns of the ground story shall be extended above roof level to permit starter bars to be left in place for a future story. An external concrete open staircase shall be provided up to the roof. The slab shall be a RCC slab designed. The floor slab shall be 5.5 kN/m² for control room floor and for live load for all floor as per BNBC-2006. If a future story is not required, a

fixed ladder of galvanized steel shall be provided up to the roof or provide temporary CI sheet shade over the stair case as per direction of the employer.

The main entrance to all buildings shall be shaded, either by a projection of the roof over the entrance verandah or by a separate roof at a lower level. This area of roof shall also be lime terraced and drained by rainwater pipes.

The head of each down pipe shall be fitted with an enlarged hopper and purpose made cast iron grill set into recess in the roof projection.

Window openings shall be fitted with protruding concrete sunshades above and at the sides of the openings.

All external walls shall be 250 mm first class brick work also provide 237.5mm x 68.75mm x 12.5mm (9.5"x2.75"x0.5") or any other standard sizes of Mirpur ceramics facing bricks or similar approved, or rendered Rustic Tiles as required by the architectural plan. The internal walls shall be generally of 125 mm thick first class brick work. Internal walls shall all be rendered and receive one sealer coat plus two finishing coats of Plastic emulsion paint. All brickwork shall be tied into the RCC frame by galvanized ties.

Externally, rendered walls shall receive primer plus two finishing coats of PEP acrylic external quality paint or similar approved.

The height of control rooms shall be provided about 1 (One) meter clearance over the top of the cabinets to the underside of the false ceiling. In the switch gear rooms, about 1 meter clearance shall be provided over the switch gear to the underside roof slab but the Contractor shall provide a greater clearance if it is required to remove equipment. The clearance may be reduced below down stand beams provided no equipment is required to be removed from the top of the switch gear. All rooms in any building shall be one height.

Control buildings housing switch gear and control equipment shall include a cable basement to facilitates connection to the equipment. Basements shall be constructed so as to protect the building sub structure from water in accordance with BS 8102.

15. Fire fitting & Fixture:

Provision for Fire fitting & fixture for Installation of fire equipment, fire detection, fire protection etc. Control room building should have the standard sized fire exit/scape with facilities and the fire scape should be designed according to floor area accommodation.

7.26.7 Ground conditions, Foundations and Site Investigation

(a) Fill Sites

On fill sites where the depth of fill exceeds 3 meters the contract assumes piled foundations

shall be installed below buildings. If placed foundations are found to be unnecessary in the final site investigation report, a reduction in contract value shall be agreed on the basis of schedule rates.

Piles shall be concrete (cast in situ or pre-cast) complying with BS 8004. Where timber piles are used, adequate strip footings shall be provided to support the building after the timber piles have deteriorated by which time settlement will be complete.

On every fill site the Contractor shall prove that his switchyard foundation will not suffer settlement greater than 20 mm by constructing a foundation and load testing this to twice the design bearing pressure for a minimum of 20 days.

Outdoor equipment shall be provided with spread footings. The Contractor will be provided by the Employer with a survey of soil levels prior to filling. The Contractor shall impose the site layout on the

survey to check for uneven depth of fill below any foundation and where uneven depth of fill exists his foundation proposals shall restrict final differential settlement to a 1 in 400 slopes.

If a fill site has not been exposed to one wet season before foundation work starts, the Contractor shall flood the site to a depth of 50 mm for 10 days (Not required on hydraulic fill site). This requirement is because silty sands will generally compact to a denser condition on first time flooding.

On all fill sites the Contractor shall pipe rainwater from pipes down to paddy level and shall prevent water pond in open foundations and backfill all foundations as soon as possible.

The Contractor shall monitor settlement of the fill (by placing concrete posts 50x50x750 mm deep on a 10 meter grid and taking readings) at 30 day intervals from the time he is given access to each fill site.

When a fill site is handed over to the Contractor, The Contractor shall become responsible for maintaining the entirety of the fill in good condition, including all batter slopes.

(b) Unfilled Sites

Original delta levels are generally 4 meters below road level. Therefore most sites are historically fill sites but fill settlement can sensibly be considered complete, where fill is over 3 years old.

(c) Site Investigation

The Contractor may appoint a sub contractor to carry out the site investigations but all work and all lab work shall be witnessed by one of his own staff who shall countersign all recorded data.

The site investigations and analysis of the data in a final report giving full details of foundation proposals shall be completed at each site by the programmed date.

Boreholes shall be taken on a 25 meter grid with at least three additional boreholes beside each building. Additional boreholes may also be required where uneven fill depth is encountered. The boreholes shall be located to an accuracy of ± 0.5 m and shall be located to site layout.

Boreholes shall be a minimum of 20 meters depth or twice building footing width, whichever

is greater or as per site condition & decision of the employer. All boreholes shall be back filled with compacted sand.

In each bore hole the following tests shall be carried out :

Standard penetration tests at 1.5 meter intervals.

Undisturbed samples shall be taken at around 1.5 meters depth and 3 meters depth and tested by unconfined compression tests.

One dimensional consolidation tests shall be carried out on undisturbed samples taken at 1.5, 3 and 4.5 meters depth. The samples shall be saturated and the range of applied pressure shall fully reflected the in situ conditions. Graphs showing void ratio (e) and applied pressure shall be submitted along with the coefficient of compressibility for the range of loading anticipated. M_v shall be in m^2/MN and shall be recorded at each stress increment. The coefficient of consolidation, c_v , shall be given in $m^2/year$.

Particle size analysis shall be carried out for each stratum and specified gravity, moisture content, liquid limit and plastic limit determined.

Ground water level shall be determined by dipping the boreholes. Where collapse of the boreholes occurs, casing shall be used and left in until the water level remains constant for two days.

In cohesive soils a vane test to BS 1377 : part 9 shall be carried out at three different depths. The Contractor shall check the aggressiveness of soil and ground water at each site to concrete and take all measures necessary to ensure the long term durability of concrete.

(d) Site Investigation Report

The report shall be submitted by the key date at each site given in the program. The Contractor shall submit 2 copies of the report to the Engineer. The report shall propose full details of foundations and loading thereon and shall provide estimates of likely settlements and differential settlements. The report shall be the work of the Contractor's own foundation Engineers.

If the Contractor uses a local site investigation contractor, he shall appoint one of his own staff to oversee the entire operation and each piece of data shall be countersigned by this person.

The Contractor shall supply, install and test at least one of the types of Pile in accordance with the approved design and the drawing showing the Piling arrangement. Each Pile shall be suitably existing the sub-strata at the site.

(e) Foundations

The minimum depth of all foundations shall be :

(i) Transformer bases bound	1.5 m
(ii) All other switchyard foundations	1.1 m
(iii) Control building foundations, foundations and internal wall foundations	1.5 m including all wall

(iv) Boundary wall foundations

1.1 m

All formations shall be hand rammed or mechanically compacted before placing 70 mm minimum thickness of Class B concrete blinding, within 24 hours of bottoming excavation, which blinding shall project 300 mm minimum distance beyond all footings. Each footing shall be inspected by the Engineer. Where soil condition is poor (on fill sites or already filled sites) or where the Contractor leaves foundations exposed and soil conditions deteriorate, one of the following measures shall be carried out as agreed with the engineer.

- (i) Blinding depth and projection shall be increased
- (ii) Soft soil shall be removed and replaced with compacted viti sand with the top 200 mm consisting of viti sand and brick chips.

The cost of this work shall be borne by the Contractor.

Between column footings all walls, including all internal wall shall be provided with a reinforced concrete strip footing of minimum dimension 800 mm wide by 250 mm deep placed at the same level as column footings and linked structurally to the footings. In addition column footings shall be tied at foundation level and also floor level by beams to every adjacent column in both orthogonal directions. These beam shall be designed to resist 1 in 200 differential settlement without distress and shall be capable of resisting the earthquake load of Rajshahi region as per BNBC 2015.

The deepest parts of any foundations shall be completed first. All foundations shall be completed and back filled, including all cable tunnel and cable trench work inside buildings, before walls are raised above floor levels. All other foundations shall be back filled within 7 days of completing concerning.

All exposed concrete and outer surfaces of cable trenches and cable tunnels shall receive two coats of bitumastic paint before back filling to reduce ingress of water. The Concrete surface shall be ground smooth and all air holes etc. filled (rubbed down with a cement slurry) before painting.

The Contractor shall monitor settlement of all foundations each month and report this settlement to the Engineer until settlement has reduced to less than 1.5 mm in 3 months.

The tops of all foundations shall terminate 1000mm above site average finished surface level. All exposed edges shall have 20 mm x 20 mm chamfers.

Excavation shall only be carried out when the ground water table at least 1000mm below foundation level. The excavation shall be kept dry during the construction period by providing sumps and pumps as required. During the rain season, shelters shall be erected over all open excavations.

Any over excavation shall be filled with Class B concrete.

All back fill shall be completed to 95% maximum dry density as defined by BS 1377 test method.

2.5 Kg rammer.

Before starting foundation work the Contractor shall clear all sites of trees, tree roots shrubs, debris, surplus soil, and any buildings.

Foundations shall be designed to resist uplift, assuming the water table is at ground level and the weight of soil resting on a foundation is that included within a 15⁰ frustum.

On fill sites where the depth of fill exceeds 3 meters, the Contractor shall provide piled foundations in accordance with BS 8004 for control buildings. If timber piles are used, adequate strip footings shall be provided to support the structure after the timber pile has deteriorated, by which time the fill will be fully consolidated. One working pile chosen by the Engineer shall be load tested at each site to 150% of design load in accordance with BS 8004.

7.26.8 Drainage

The entire surface within boundary walls shall be of uniform sloping site, sloping at q in 150 minimum slope to open channels around the entire perimeter. These channels shall be designed for a rainfall intensity of 60 mm per hour. Outside the boundary wall the contractor shall be responsible for drainage up to 20 meters from the wall and will at some sites need to construct outlets with suitable erosion protection down to paddy level.

The concrete wall of cable trenches shall project at least 70 mm above brick paving level to prevent run off entering the cable trench. The floors of all cable trenches /tunnels shall be sloped to soak ways.

The cable trenches shall be free from surface water drainage. If the cutoff area exceeds 30 m² it shall be drained by a 200 mm minimum diameter concrete pipe to the boundary drain. The Contractor's drainage design shall avoid all pond water to avoid forming a mosquito breeding ground.

All drainage pipe work within buildings shall be ductile iron, generally of 100 mm diameter. Floor drains shall be placed in each battery room and toilet.

External Pipe work shall be 150 mm minimum diameter concrete pipes at a minimum depth of invert of 700 mm. Where pipes, including existing pipes along with site, are less than 400 mm above adjacent foundations they shall be surrounded in concrete. Where required, drainage pipes shall be kept below cables, allowing 1.1 m cover to top of pipes.

Manholes shall be of brick construction with 600mm x 600mm clear openings and air tight ductile iron covers to BS EN 124. Manholes shall be located at each change of direction. Minimum fall on all pipelines shall be 1 in 80. Manhole shall not be located in roads.

The Contractor shall be responsible for all negotiations with local authority WASA where a connection to a public sewer is proposed. Where high water levels in public sewers may cause effluent to back up into a site, non return valves shall be fitted. The Contractor shall provide all protection required to existing sewers and shall deepen foundations, including boundary wall foundations, where required all foundations are below adjacent sewers. The Contractor shall draw longitudinal sections of all pipelines. Each control building shall be provided with a septic tank designed for 50 users and a soak away of open brick construction 10 m deep by 2.2 m diameter filled with broken bricks. The septic tank shall be located at least 15 meters from buildings. Other buildings shall have septic tanks designed for the required number of users. All foul drains shall be vented by a vent pipe to above roof level. The inner surface of all manholes and septic tanks shall be painted with 2 coats of bitumastic paint to protect it against sulphate attack. The septic tank shall have access holes directly over the inlet pipes and outlet pipes.

Where public sewers exist alongside a site, the Contractor shall connect directly to the foul sewer, provided effluent from the sewer is treated.

The Contractor shall construct the drainage first to ensure that at no stage is rainwater ponded on any part of the site. All rainwater shall be able to run off the site or shall be immediately pumped off site by the Contractor. The Contractor shall complete all necessary drains before casting any roof and large concrete area which will create large run off. The condensate drains for the air conditioning shall also be connected to the drainage. Two vents of minimum height 2.2 m shall be provided on each septic tank.

If a town's water supply is unreliable, the roof rain water shall be collected in an underground tank of standard Employer's design. Scope of this work shall be agreed at Bid stage.

7.26.9 Earth Work

7.26.9.1 Scope

This clause covers the performance of all works in connection with the required excavation for the various type of foundations and equipment, as shown in the drawing, or any other excavation and banking that may be necessary during the progress of works including the removal, use or disposal of all excavated materials.

7.26.9.2 Clearing

- (1) Clearing shall mean include the remove of trees and shrubs, stumps and other objectionable matters from the area necessary for the works. The contractor shall cut and remove them from the project area or turn them as approved by the Engineer.
- (2) By no means shall the contractor fell any trees outside the premise of the construction site without permission of the parties concerned even if such trees cause obstacle against smooth execution of the work. Therefore, any such trees shall be felled upon negotiation with and permission of the possessor.

7.26.9.3 Excavation

- (1) Excavation under this section shall consist of the removal, hauling, dumping and satisfactory disposal of all materials from required excavations.
- (2) The excavated slope surface shall be protected against any erosion due to heavy rains during construction period. Should any damage be caused on any face of slope, the contractor shall immediately repair any such damage at his expense.
- (3) Excavation shall be carried out by adopting a suitable excavation for the ground so as not to loosen the ground outside the excavation. If necessary, temporary sheeting shall be constructed.
- (4) During excavation, work shall be performed carefully so as not to cause any damage to adjacent structures and buried structures.
- (5) If the excavated material is to be temporarily stockpiled, designated spaces shall be kept from the shoulder of the road while considering the earth pressure at the excavated

surface and the working space. Temporary sheeting or other such structures, if necessary, shall be constructed so that the stockpile can be protected from damage or being washed away.

- (6) Excavation of road, if any, shall be done in such a manner as not to hamper vehicular traffic. If excavation is to be performed in the vicinity of residences, appropriate care shall be taken so as not to hinder the passage of residents.
Spoils, materials and equipment shall be carefully handled.
- (7) After completion of excavation, excavated widths and bottoms shall be subject to inspection by the engineer.
- (8) Blasting shall not be employed during excavation.
- (9) Any and all excess excavation for the convenience of the contractor or over-excavation performed by the contractor for any purpose or reason, except may be ordered in writing by the engineer, and whether or not due to the fault of the contractor, shall be at the expense of the contractor. All such excess excavation and other excavation shall be filed at the expense of the contractor with materials approved by the engineer.
- (10) The contractor shall be entitled to request the engineer in writing to change the excavation line as required according to the soil conditions of the foundation following the progress of excavation. In such a case, upon excavation up to the laid excavation line, the contractor shall prepare the detailed design drawing of the said foundation and submit it to the engineer for his approval.
- (11) All objectionable materials such as, oil, mud, rock fragments, loose rock, chips, mortar, organic matters and stagnant water, shall be removed from the surface of the foundation.

7.26.9.4 Sheeting

- (1) Sheeting shall be of the type that is suitable to the condition of foundation and Groundwater and shall have a safe structure.
- (2) If sheet piles on retaining piles are to be driven at the piling location in the vicinity of buried structures, where they shall be investigated and confirmed by manual trench excavation etc. prior to piling in order to protect these structures from being damaged
when piles are to be pulled out, carefulness shall be taken into account to cause no damage to the buried structures.

7.26.9.5 Banking

Foundation of banking shall be treated as follows:

- (1) Any material having a harmful effect on banking shall be removed.
 - (a) Where inflow of ground water is expected, it shall be treated so as not to cause inundation.
 - (b) In case of sloped ground with unfavorable conditions, such as unsuitable soil,



poor drainage, etc, a method, such as excavating the ground into steps in advance in order to increase its stability, shall be planned and reported to the Engineer.

- (2) Unless otherwise specified, settlement allowance shall be 3 per cent of the height of the banking and the surface shall be graded evenly within ± 5 cm.
- (3) Materials for banking shall not include any harmful materials, such as fertile soil or pieces of wood.
- (4) Materials for banking shall not be of an extremely swelling nature.
- (5) Impermeable clay shall not be used for back-filling of a structure which is susceptible to earth pressure.
- (6) Banking shall be formed by spreading soil of less than 50 cm in thickness and by sufficiently compacting each layer.
- (7) The type of compactor shall be one that is suitable for banking materials.
- (8) Materials for banking shall be so treated as to have optimum water content in percent of dry weight.
- (9) Rocks shall be spread out evenly so as not to form any void space.
- (10) Temporary facilities shall not be buried in banking. If it becomes inevitable to do so, it shall be reported to the engineer and shall be approved by the engineer, upon which appropriate measures shall be taken to prevent any unfavorable effect on the banking.

(11) As a standard, extent of satisfactory compaction shall be as follows : $K_{75} = 1.5$

Kg./cm³ or more, Where : K_{75} is a coefficient of bearing capacity determined by the plate load test.

When required by the engineer, the contractor shall perform in-situ tests and penetration tests to confirm the extent of compaction and the result shall be submitted to the engineer.

(12) Any banking work on rainy day shall be carried out upon approval of the Engineer.

7.26.9.6 Back-Filling

- 1) Back filling shall be executed as construction proceeds along with the removal of shoring and other materials at the back filling site.
- 2) When sheeting is to be left and buried in order to prevent shear failure of soil or due to some other inevitable reasons, it shall be done so according to the direction of the engineer.
- 3) Except those which are specified in the specifications or the drawings, all the materials for back filling shall be in accordance with the clauses of "Banking" 2.5 of these specifications.
- 4) If the inflow of water exists at the site of back filling it shall be appropriately treated.

- 5) In back filling, the layer of spreading shall be around 50cm or less per lift, and it shall be graded as horizontally as possible, and shall be sufficiently compacted by hydraulic filling or by use of an appropriate compactor such as a rammer.
- 6) Extent of compaction shall be such that it will prevent future settlement and such that the designated bearing capacity can be obtained. If necessary, the extent of compaction shall be measured by a cone penetrometer etc. and the record shall be submitted to the engineer.
- 7) If there is any surface or buried structure owned by the public or the third party at the site of back filling, care shall be taken so as to cause no harmful effect to them, and the execution of the work shall be carried out following direction by the engineer and in the presence of relevant administrators.
- 8) For back filling adjacent to a structure, compaction and back filling shall be carried out in such a manner that will prevent damage to the structure.

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

7.26.9.7 Disposal of Excavated Materials

- (1) Spoils produced by excavation shall be piled, graded, sloped or disposed of at the locations specified by the Board or Engineer and it shall be subject to inspection by the engineer. Spoil, whose disposal areas are not specified by the engineer, shall be disposed of by the contractor at his responsibility.
- (2) In transporting the spoils, care shall be taken so as to neither hamper traffic nor cause trouble to the third party by scattering the spoil over the road.

7.26.9.8 Gravel Layer

- (1) Gravel and rubble produced locally shall be used. Gravel layer shall, in principle, be laid in a single layer with no large gaps, sand on end and interstices shall be filled with granular gravel.
- (2) The compaction shall be executed by a compaction machine (rammers, etc.)
- (3) Gravel layer shall be well compacted together with covering gravel and shall be graded and finished to the designated level.

7.26.10 Piling

7.26.10.1 Pile Driving

- (1) Piles shall be driven by a pile driver, suitable for the type and size of the piles, geological conditions and construction environment, and in such a manner as to cause no public nuisance, such as noise, to the third party.
- (2) The method for construction joint of piles shall be submitted in writing to the engineer and shall be subject for approval by the engineer.

- (3) Records shall be kept during the piling operation and these shall be submitted to the engineer.
- (4) Piles shall be driven vertically and at the exact locations indicated in the drawings, and piling shall be continuous without interruption to avoid deviation of pile head.
- (5) Caps and other suitable materials shall be used as a cushion to protect the head of piles.
- (6) Toward the end of driving the amount of penetration shall be measured for each pile as directed by the engineer.
- (7) Should it be difficult to drive any pile up to the specified depth, the contractor shall carry out such piling work in accordance with the instructions of the engineer.
- (8) Method and equipment of pile driving to be employed for construction works shall be subject to approval of the engineer prior to execution.
- (9) When driving a group of piles, driving shall begin from the center and gradually moved outward.
- (10) When eccentric error exceeds the allowable values shown in the table below or when a pile is damaged or creaked during piling operation, it shall be reported to the engineer, and the pile shall be replaced or an additional pile shall be driven.

<u>Type of Foundation</u>	<u>Allowance</u>	<u>Remarks</u>
All foundations	10 cm or less	

- (11) Upon completion of piling, any void portions inside piles shall be filled back with soil obtained from at site excavation.

7.26.10.2 Field Joining of Piles

- (1) Field joining of piles shall be carried out by arc welding.
- (2) Welders shall have not less than 6 months continuous experience in welding of pile, and shall be qualified by JIS Z-3801, "Standard Qualification Procedures for welding Technique", or equivalent BDS.
- (3) Arc welding rods shall be standard items specified in IETC (International Electro technical Commission) or equivalent "Covered Electrodes for Mild Steel", or equivalent. Welding rods shall be completely dry prior to use.
- (4) The welding surface of parent metal shall be carefully cleaned of slag, moisture, dust, rust, oil, paint or other foreign matter.
- (5) The root face of steel pipe pile shall be 2mm,

- (6) Welding shall be performed carefully by selecting welding current and welding speed which ensure complete penetration of welding rod to avoid cracks in any portion of the weld.
- (7) Welding shall not be performed when the parent metal is wet from rainfall or when strong winds are blowing. However, when the portion to be welded is suitably protected, welding may be performed upon approval of the engineer.
- (8) If harmful defects or cracks have been found in the weld, the deposited metal shall be carefully chipped off and the affected part shall be re-welded and then inspected by the engineer.

7.26.10.3 Treatment of Pile head

- (1) The head of the piles shall be cut to the designated level and shall be embedded into the footing.
- (2) The steel pipe piles shall be anchored into the footing by a method specified otherwise.

7.26.10.4 Transportation and Handling

Care shall be taken in transportation and handling of pile so as to prevent damage to them.

If the pile is damaged or deformed to the extent that it is impractical for the intended use, the contractor shall repair it prior to driving, and it shall be inspected and approved by the engineer.

7.26.11 Reinforced Concrete Work

7.26.11.1 General

- (1) This clause covers the performance of all reinforced concrete work for permanent structures in accordance with the drawings and these specifications.
- (2) The contractor shall furnish all materials and equipment for the performance of concrete work.
- (3) Reinforced concrete work and plain concrete work shall comply with ACI (American Concrete Institute), BNBC (Bangladesh National Building Code) or equivalent standard.
- (4) Covering
 - (a) The covering shall be at least one diameter of the reinforcement.
 - (b) In general, the covering shall be at least those shown in Table-1.

Table-1 : Minimum Covering (mm)

Conditions	Slabs	Beams	Columns
When not directly exposed to rain or wind	20	40	40
Large and important structure, or when exposed to Rain or wind	25	40	65
When effective coating is not applied on the portion Which may be subjected to injurious chemical reaction			
Due to smoke, acid, oil, salts, etc.	37.5	50	75

- (c) In case of footings and important members of a structure it is recommended that the covering be at least 7.5 cm when concrete is placed directly facing the ground, and at least 5 cm for bars with diameter of more than 16mm and 4 cm for bars with the diameter of less than 16 mm when the concrete is buried and directly facing the ground or when it is subjected to severe weather conditions. However, the covering at the bottom side of slabs may be at least 2.5cm even if the portion of it is subjected to extreme weather condition.
- (d) The covering in structures which are required to be especially fire-proof shall be determined based on the temperature of the fire, duration, characteristics of aggregate to be used, etc.

7.26.11.2 Quality of Concrete

(1) General

Concrete shall have the uniform quality with the required strength, durability, watertightness etc.

(2) Strength

- (a) The strength of concrete shall generally be based on 28 days compressive strength.
- (b) Compression tests for concrete shall be performed in accordance with ACI, BNBC or equivalent standard.

7.26.11.3 Materials

Materials used for the construction of buildings shall conform to standard specifications listed in this part of the Code. Any deviation from the type design or architectural detail from those specified in these standards may be accepted by the Building Official as long as the materials standards specified therein are conformed with.

7.26.11.4 Cement

Cement for shall be Ordinary Portland Cement complies with the standards listed as follows: BDS 232: 1974, Portland Cement (Ordinary and Rapid Hardening) or ASTM C150, Portland Cement; ASTM C91, Masonry Cement; ASTM C595, Blended Hydraulic Cements.

Cement for other than masonry shall conform to the following standards: BDS 232, Portland Cement (Ordinary and Rapid Hardening); BDS 612, Sulphate Resisting Portland Cement-Type A; ASTM C150, Portland Cement; ASTM C 595, Blended Hydraulic Cements; and to other such cements listed in ACI 318.

7.26.11.5 Water

- (1) Water shall be free from injurious amounts of oils, acids, salts, organic materials or other materials that may be detrimental to concrete.
- (2) Sea water shall not be used in mixing concrete for reinforced concrete.

7.26.11.6 Fine Aggregate

(1) General

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

Beach sand shall not be used for concrete.

(2) Grading

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

Table-2 : Standard Grading of Fine Aggregate

Nominal Size of Sieve (mm)	Weight percentage of those passing a sieve	Nominal size of sieve (mm)	Weight percentage of those passing a sieve
10	100	0.6	25 – 65
5	90 – 100	0.3	10 – 35
2.5	80 – 100	0.15	2 – 10
1.2	50 – 90		

Sieve analysis shall be in accordance with JIS A 1102, or equivalent BD standard.

7.26.11.7 Coarse Aggregate

(1) General

Coarse aggregate shall be clean, strong, hard, durable, suitably graded and free from injurious amounts of flakes, elongated pieces, organic impurities, salts etc.

(2) Grading

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

Sieve analysis shall be performed in accordance with JIS A 1102, or equivalent BD standard.

Table-3 : Standard Grading of Coarse Aggregate

SS (mm)	Weight percentage of those passing a sieve

SA (mm)		50	40	30	25	20	15	10	5	2.5
			95			40		10	0	
	40	100								
			100			65		30	5	
					95		30		0	0
	25			100						
					100		70		10	5

SS : Nominal Size of Sieve SA : Size of Aggregate

7.26.11.8 Reinforcement

Reinforcement in masonry shall conform to the standards listed as follows: ASTM A82, Cold Drawn Steel Wire for Concrete Reinforcement; ASTM A615M, Deformed and Plain Billet Steel Bars; ASTM A616M, Rail-Steel Deformed and Plain Bars; ASTM A617M, Axle-Steel Deformed and Plain Bars; ASTM A706M, Low-Alloy Steel Deformed Bars; ASTM A767M, Zinc-Coated (Galvanized) Steel Bars; and ASTM A775M, Epoxy - Coated Reinforcing Steel Bars.

7.26.11.9 Crushed Stones

Crushed Stone to be used as coarse aggregate shall conform to the following standards: BDS 243 : 1963, Coarse and Fine Aggregates from Natural Sources for Concrete; ASTM C33, Concrete Aggregates; ASTM C330, Lightweight Aggregates for Structural Concrete; ASTM C637, Aggregates for Radiation-Shielding Concrete; ASTM C332 , Lightweight Aggregate for Insulating Concrete; IS: 9142 Artificial Lightweight Aggregates for Concrete Masonry Units.

7.26.12 Admixture

Admixtures to be used in concrete shall be subject to prior approval by the Building Official and shall comply with Sec. 2.4.5.1 through 2.4.5.5.

- **Chloride** : Calcium chloride or admixtures containing chloride from admixture ingredients shall not be used in prestressed concrete, concrete containing embedded aluminum in concrete cast against permanent galvanized metal forms, or in concrete exposed to severe or very severe sulphate-containing solutions (see Sec 5.5.2.1 of Part 6).
- **Standards** : Air-entraining admixtures shall conform to ASTM C260. Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and retarding admixtures, and water-reducing and accelerating admixtures shall conform to ASTM C494, Chemical Admixtures for Concrete, or ASTM C1017, Chemical Admixtures for Use in Producing Flowing Concrete.
- **Pozzolanas** : Fly ash (Pulverized Fuel Ash) or other pozzolans used as admixtures shall conform to ASTM C618.
- **Blast Furnace Slag** : Ground granulated blast-furnace slag used as an admixture shall conform to ASTM C989.
- **Pigment for Coloured Concrete** : Pigment for integrally coloured concrete shall conform to ASTM C979.

7.26.13 Storage of Materials

7.26.13.1 Storage of Cement

- (1) Cement shall be stored separately for each type in either silos or damp-proof warehouses.
- (2) Silos to store cement shall be built or equipped with suitable means so that cement will not be retained at the bottom without being conveyed out. In case of sacked cement, it shall be stacked on the floor rising at least 30 cm from the surface or the ground, and shall be stored in such a manner as to facilitate conveyance and inspection. Height of each stack shall be at most 13 sacks.
- (3) Any portion of Cement which has hardened during its storage shall not be used at all. Cement stored for long period shall be tested for its quality prior to its use.
- (4) Cement with excessively high temperature shall be used only after lowering the temperature.

7.26.13.2 Storage of Aggregate

- (1) Fine aggregate, coarse aggregate and other aggregate of different type and grading shall be separately stored between each.
- (2) When receiving, storing and handling aggregate, facilities shall be well maintained, and handling shall be carefully performed so that no segregation of large particles from small ones may occur, no foreign materials may become mixed, or in case of coarse aggregate, no particles may be crushed.
- (3) Storage facility of aggregate shall be equipped with a suitable drainage system, and shall have a suitable capacity so that the aggregate with uniform surface water may be used and the aggregate received may be used after being tested.
- (4) In hot weather, aggregate shall be stored in a place with a facility to avoid direct exposure to the sun etc. so that extreme drying or temperature rise in the aggregate does not occur.

7.26.13.3 Storage of Reinforcement

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

7.26.13.4 Storage of Admixture

- (1) Admixture shall be stored so as to be free from dusts and other impurities. Admixture in power form shall be stored in such a manner that absorption of water and hardening are prevented, and admixture in liquid form shall be stored in such a manner that segregation and change in quality are prevented.
- (2) Admixture materials shall be carefully handled so as not to be scattered.
- (3) Admixture material shall be stored in silos or warehouses which are desirably damp-proof and shall be used in the same order as they are received.
- (4) Admixture stored for a long period of time found to have changed shall be tested prior to its use. Should it be found in the test that the admixture does not possess the required

characteristics, its use shall not be allowed.

7.26.13.5 Testing of Materials

- (1) The all materials (cement, water, fine aggregate, coarse aggregate, reinforcement, admixture, etc.) to be used shall be approved by the engineer after the contractor submits the results of tests.
- (2) The testing method shall comply with the various codes of ASTM, ACI, BNBC or equivalent standard.

7.26.14 Mix Proportions

7.26.14.1 General

- (1) Mix proportion for concrete shall be determined in such a manner that the unit quantity of water is minimized while the required strength, durability, water tightness and the workability suitable for the work are secured.
- (2) Mix proportion for concrete and results of test mixing shall be determined so as to provide the required strength, workability, uniformity and durability. The scheme of mixproportion shall be submitted to the engineer for approval, The attached form of submission shall be used. The design strengths of the concrete shall be the classes indicated below.

4 Fc =	210 kg/cm ²	For Architecture and Switchyard
4 Fc =	180 kg/cm ²	For Transmission
4 Fc =	120 kg/ cm ²	For leveling Concrete

Where 4 Fc means concrete compressive strength at the age of 28 days.

Basic design date for mixing are indicated in the table herein.

Table – 4 : Basic Mix Data

Class	Design strength _{4Fc} (kg/cm ²)	Maximum size of aggregate(mm)	Slump (cm)	Air entertainment (%)	
E	210	25	10 – 15	4 1	Architecture Switchyard
B	180	40	10 – 15	4 1	Transmission
C	120	40	10 – 15	4 1	Leveling Concrete

Note :

1. Specific gravity in design
Cement – 3.15, Fine Aggregate – 2.62, COARSE Aggregate and Crushed

Stones – 2.62

2. Relationship between C/W (Cement water ratio) and maximum compressive strength at 28 days. $\sigma_{28} = 210 + 215 \text{ C/W}$

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					Quantity (per mixed 1 m ³) (kg/m ³)				
Maximum size or aggregate (mm)	Slump	Air entrainment (%)	Maximum water / cement W/c (%)	Sand percentage S/a (%)	Water W	Cement C	Fine aggregate	Coarse aggregate	Admixtures
								mm-mm	mm-mm

7.26.15 Batching and Mixing

7.26.15.1 Batching

- (1) General

Each material to be used in concrete is obtained.

- (2) Batching Equipment

- Batching method and batching equipment for each material shall be subject to the approval of the engineer in advance.
- Batching equipment for each material shall be inspected and adjusted, if necessary, prior to the commencement of the construction work and periodically during the construction.

- (3) Batching of materials

- Batching shall be made in accordance with the job mix. Test for surface water of the aggregate shall be in accordance with ASTM or equivalent or as directed by the engineer. Test for the quantity of the effective absorption of water, in case of dried effective absorption of water, shall be as directed by the engineer.
- Volume of one batch shall be determined as directed by the engineer.
- Each material shall be batched by weight for each batch except the water and the solution of admixture, which may be measured by volume.
- Error in the measurement in each batch shall be at most the values given

in Table5.

Table-5 : Allowable Error in Measurements

Type of Materials	Permissible Error (%)
Water	1
Cement & Admixture Material	2
Aggregate	3
Solution of Admixture Agent	3

7.26.15.2 Mixing

All concrete shall be mixed thoroughly until there is a uniform distribution of materials and shall be discharged completely before the mixer is recharged.

Ready mixed concrete shall be mixed and delivered in accordance with the requirements of "Specification for Ready Mixed Concrete" (ASTM C94) or "Specification for Concrete Made by Volumetric Batching and Continuous Mixing" (ASTM C685). Job mixed concrete shall be mixed in accordance with the following:

- a) Mixing shall be done in a batch mixer of approved type.
- b) Mixer shall be rotated at a speed recommended by the manufacturer.
- c) Mixing shall be continued for at least 90 seconds after all materials are in the drum, unless a shorter time is shown to be satisfactory by the mixing uniformity tests of "Specification for Ready Mixed Concrete" (ASTM C94).
- d) Materials handling, batching, and mixing shall conform to the applicable provisions of "Specification for Ready Mixed Concrete" (ASTM C94).
- e) A detailed record shall be kept to identify:
 - i) number of batches produced;
 - ii) proportions of materials used;
 - iii) approximate location of final deposit in structure;
 - iv) time and date of mixing and placing.

(1) General

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

(2) Mixers

- (a) Mixers shall be either tilting batch mixers or forced batch mixers.
- (b) Any concrete mixers to be used under this project shall be subject to approval of the engineer.
- (c) Mixers shall be such that they will not cause any separation of materials at the time of discharging.

(3) Mixing

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

- (b) Mixing time shall, in principle, be determined based on tests. As a standard, it shall be atleast 1 minute and 30 seconds for tilting type mixers and 1 minute for forced mixers.
- (c) Mixing shall not be continued for more than three times the specified mixing time.
- (d) Materials for new batch shall not be charged into the mixer until all the concrete in the mixer is discharged.
- (e) Mixers shall be thoroughly cleaned before and after their use.
- (f) Concrete left as mixed and commenced setting shall not be used after re-tempering.

7.26.16 Conveying and Placing

- (1) Prior to the commencement of the construction work, a plan of conveying and placing shall be made and this shall be subject to the approval of the engineer.
- (2) Concrete shall be conveyed by methods which will minimize separation and loss of materials, shall be placed immediately and then shall be thoroughly compacted. Even when it is impossible to place the concrete immediately due to some special reasons, the time between mixing and the completion of placing shall not exceed 45 minutes.
During the waiting period, the concrete shall be protected against direct exposure to the sun, wind and rain, and the concrete left for a relatively long time shall be re-mixed without adding any water. No portion of concrete which has started to harden shall be used.
- (3) When extreme separation is observed in concrete during its delivery or placement, it shall be made uniform in quality by re-mixing.

7.26.16.1 Conveying

- (1) Conveying

Equipment to be used in conveying concrete shall be those which can easily deposit. Should the delivery distance be long, they shall be equipped with such facility as an agitator.

- (2) Buckets

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

- (3) Belt Conveyors

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

(4) Buggies and Trolleys

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

(5) Chutes

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

7.26.16.2 Placing

(1) Preparation

- (a) Prior to the placement, the arrangement of reinforcement, forms etc. shall be approved by the engineer.
- (b) Prior to the commencement of the placement, it shall be certified that conveying equipment and placing equipment are in conformance to the plan of placing specified in Clause-____
- (c) Prior to the placement, conveying equipment, placing equipment and the inside of forms shall be thoroughly cleaned to prevent foreign materials from being mixed into the concrete. Portions expected to face concrete and to absorb water shall be moistened in advance.
- (d) Water in pits and sumps shall be removed prior to the placement of the concrete. Suitable protective measures shall be taken so that water running into these pits and sumps will not wash the concrete just placed.

(2) Placing

- (a) Concrete shall be placed in accordance with the plan of placing

specified in Clause___should it be inevitable to change the placing method, it shall be so done as directed by the Engineer.

- (b) When concreting is done in hot weather, special attention shall be given to the materials, placement, curing etc.
- (c) Portions such as the ground and foundations which may absorb the water in concrete shall be thoroughly wetted prior to the placement of concrete.
- (d) Temperature in concrete at the time of placing shall be at most 35° C.
- (e) Conveying equipment for concrete shall be such that they will protect concrete from being dried or heated.
- (f) Concrete shall be protected as soon as the placement is completed or interrupted. Special care shall be exercised to keep the surface of the concrete moist.
- (g) During the concreting operation, attention shall be paid not to disturb the arrangement of the reinforcement.
- (h) Concrete shall be embedded into concrete with abundant mortar. Should any notable separation of materials be observed during concreting, the concrete shall be removed to obtain the uniform quality and necessary measures to prevent separation shall be taken before the placing operation is resumed.
- (i) Concrete for one section shall be placed continuously until it is completed.
- (j) Concrete shall, in principle, be placed in such a manner that the surface of the placed concrete will be horizontal within the section. One lift in placement shall be at most 40 cm, in principle.
- (k) Should concrete be placed in layers, each succeeding layer shall be placed while the one below it is still plastic. Should it become necessary to place concrete on top of a layer which has started setting, it shall be done in accordance with Clause 4.10.
- (l) When height of the form work is great, it shall be provided with openings for concrete placing, or the placement shall be done using from chutes in order to prevent the concrete from being segregated or from adhering to the reinforcement or to the forms above the layer to be placed.
- (m) The height of the end of buckets and hoppers shall be at most 1.5 m above the level of placement.
- (n) Should there be any water coming out and accumulated during the



placement, the concrete shall not be placed further until the water is removed by a suitable means.

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

7.26.17 Compaction

- (1) In principle, internal vibrators shall be used to compact the concrete. When it is difficult to use internal vibrators in the case of thin walls, form vibration shall be used.
- (2) Vibrators to be used shall be subject to the approval of the engineer.
- (3) Concrete shall be thoroughly compacted immediately after placement and shall be thoroughly worked around the reinforcement and into the corners of the form. Where conditions take compaction difficult, batches of mortar containing the same proportions of cement, sand and water as used in the concrete shall first be deposited to certify the compaction.
- (4) When compaction is achieved by vibrators, it shall be inserted into the layer below the one just placed by about 10cm. The vibrators shall be pulled out very slowly so that no hole will form in the concrete.
- (5) When concerning is to be compacted by internal vibrators, the spacing and the time of their application shall be as directed by the engineer.

7.26.18 Additional Placing

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

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

The contractor shall report the said method to the engineer and obtain his approval.

- (b) Concrete shall be protected from vibrations, impacts and loads while it is hardening.
- (2) Wet Curing
 - (a) Concrete being placed and compacted shall be protected from the sun,

wind, showers etc.

- (b) Any exposed surface of concrete which has hardened to a degree that works can be done without impairing it shall be either covered with wet mats, canvas, sand etc. or directly watered, and shall be kept moistened continually for at least 5 days after the placement in case ordinary Portland cement is used.
- (c) When sheathing boards are expected to become dry, they shall be watered.

7.26.19 Joints

(1) General

- (a) Location and structure of joints as shown and specified in the drawings shall be observed.
- (b) Should any joint not specified in the design be made, its location, direction and method of construction shall be determined in the plan of construction so that it will not impair the strength and the appearance of the structure, and this shall be subject to the approval of the engineer.

(2) Construction Joints

- (a) Construction joints shall be located where the shear acting there is as small as possible, and with their face in perpendicular, in principle, to the direction of compression in the member.
- (b) Should it be unavoidable to make a construction joint at a location where large shear is action, it shall be reinforced by forming tenors or grooves, or embedding suitable steel.

(3) Construction of Horizontal Construction Joints

- (a) Sided of the surface of a horizontal construction joint intersecting the forms shall be kept as horizontal and straight as possible.
- (b) When new concrete is placed, the surface of the old concrete shall be removed of all laitance, interior concrete, loosened aggregate, etc. and shall be thoroughly wetted.
- (c) Prior to the placement of new concrete, the forms shall be tightened, and either cement paste or mortar with the same mix proportions as in concrete shall be applied on the surface of the old concrete.

The concrete shall then be placed immediately and shall be compacted so that it will be in tight contact with the old concrete.

(4) Construction method for Vertical Construction Joints

- (a) When a vertical construction joint is to be made, the forms at the joint shall be rigidly supported, and the concrete in the vicinity of the point shall be thoroughly compacted by vibrators.
- (b) Fresh concrete shall be placed after the surface of the aged concrete at the joint is removed of the surface film or is roughened and thoroughly wetted, followed by the application of cement paste or mortar, or after the surface is treated as directed by the engineer.
- (c) Fresh concrete shall be thoroughly compacted at the time of placement so that the fresh and the aged concrete is in tight contact with each other. It is recommended that the new concrete be compacted again after a suitable delay by applying vibration.

7.26.20 Reinforcement Works

7.26.20.1 Processing of Reinforcement

- (1) Reinforcement shall be processed to the shape and the dimension as shown in the drawings by a method which will not impair the quality of the material.
- (2) Reinforcement shall be processed in ordinary temperature. When it is unavoidable to heat for processing, the whole process shall be subject to the approval of the engineer.

7.26.20.2 Fabrication of Reinforcement

- (1) Prior to fabrication, reinforcement shall be thoroughly cleaned and free from loose rust and any other material which may impair the bond between the reinforcement and the concrete.
- (2) Reinforcement shall be placed to the designated position, and shall firmly be fabricated so that it will not be dislocated ruining the placement of concrete. Erection bars, if required, shall be used for this purpose.

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

- (3) Clearance between reinforcement and sheathing board shall be maintained correctly by use of spacers.
- (4) Reinforcement shall be always inspected by the engineer after the completion of fabrication.

7.26.20.3 Joints of Reinforcement

- (1) Lap joints of reinforcement shall be made by lapping the required lengths and fastening them together at several points with annealed wire of at least 0.9mm

in diameter.

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

7.26.21 Forms and Timbering

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

7.26.21.1 Materials

Materials to be used for the form and the timbering shall be selected based on the strength, rigidity, durability, workability, effect on the concrete to be placed.

7.26.21.2 Design of Forms

- (1) Forms shall be those which can easily be fabricated and stripped; joints of sheathing boards and panels shall be forced in parallel with or perpendicular to the axis of the member so that it will have a structure which is tight against mortar.
- (2) The structure of form shall be such that the corners of concrete can be moulded even when it is not particularly specified.
- (3) Temporary openings, if necessary, shall be made at suitable locations to facilitate cleaning and inspection of the forms and the placing of concrete.

7.26.21.3 Design of Timbering

- (1) Suitable types of timbering shall be selected and the load carried by them shall be correctly transferred to the foundation by appropriate means.
- (2) As for the timbering for important structures, design drawings shall be prepared by them; they shall be subject to the approval of the engineer.

7.26.21.4 Construction of Forms

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

7.26.21.5 Construction of Timbering

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

7.26.21.6 Inspection of Forms and Timbering

- (1) Forms and timbering shall be inspected by the Engineer prior to the placement of contents.
- (2) Condition of forms and timbering shall be inspected during the placement of concrete.

7.26.21.7 Removal of Forms and Timbering

- (1) Forms and timbering shall not be removed until the concrete reaches a strength required to carry the concrete weight and the load applied during the construction work.
- (2) Time and sequence of the removal of the forms and timbering shall be subject to the approval of the engineer.

7.26.21.8 Loading on a Structure Immediately After Removal of Forms and Timbering

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

7.26.22 Finishing

7.26.22.1 General

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

7.26.22.2 Surface Not Facing Sheeting Boards

- (1) Surface of the concrete compacted and approximately leveled to the required level and shape shall not be finished until the water coming out ceases or is removed.
- (2) Cracks formed after finishing but before hardening shall be removed by tamping or re-finishing.

7.26.22.3 Surface Facing Sheathing Boards

- (1) Concrete which will be exposed shall be placed and compacted in such a manner that the surface solely composed of mortar will be secured.
- (2) Projections and lines formed on the surface of concrete shall be removed to ensure surface flatness. Honeycombs and chipped places shall be removed and the surface shall be moistened and patched with appropriately proportioned concrete or mortar to be finished flat.
- (3) Cracks formed after the removal of the forms due to temperature stress, drying shrinkage, etc. shall be repaired as directed by the Engineer.

7.26.23 Quality Control and Inspection

7.26.23.1 General

Materials of concrete, reinforcement, equipment's and workmanship shall be controlled produce reinforced concrete of the required quality economically.

7.26.23.2 Tests of Concrete

- (1) During construction, the following tests shall be carried out as directed by the Engineer.
- (2) Air test
- (3) Compression test of concrete.
- (4) Others

7.26.23.3 Inspection of Forms and Timbering

- (1) Forms and timbering shall be inspected by the Engineer Prior to the placement of contents.
- (2) Condition of forms and timbering shall be inspected during the placement of concrete.

7.26.23.4 Removal of Forms Timbering

- (1) Forms and timbering shall not be removed until the concrete reaches a strength required to carry the concrete weight and the load applied during the construction work.
- (2) Time and sequence of the removal of the forms and timbering shall be subject to the approval of the Engineer.

7.26.23.5 Loading on All Structure Immediately after Removal of Forms and Timbering

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

7.26.24 Finishing

7.26.24.1 General

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

7.26.24.2 Surface Not Facing Sheathing Boards

- (1) Surface of the concrete completed and approximately leveled to the required level and shape shall not be finished until the water coming out ceases or is removed.
- (2) In order to determine the suitability of the curing method and the time to

remove the forms, and in order to certify the safety for early loading, strength tests shall be performed on specimens cured under the conditions as similar as possible to those of the concrete at the site.

Should the result of the test indicate that the obtained strength of the specimen is much smaller than that of the specimens cured under the control condition, the method of curing at the site shall be changed as directed by the Engineer.

- (3) For Compression test of concrete, six (6) test specimens shall be required for each concrete. Three (3) specimens shall be tested for seven (7) or fourteen (14) days strength, the remained three(3) specimens shall be tested for twenty-eight (28) days strength.

The expense for the above tests shall be included in the unit prices.

- (4) Should it become necessary after the completion of the work, non-destructive test of concrete or tests on concrete specimens cut from the structure shall be carried out.

7.26.24.3 Test of Reinforcement Bars

In the case where there is no test certificate of reinforcement bars (mill sheet) or in case the Engineer deems necessary, the contractor shall carry out the characteristics test of reinforcement bars and obtain an approval of the Engineer.

7.26.24.4 Test Method

Test method shall conform to those specified in ASTM, ACI, BNBC or equivalent, unless directed otherwise by the Engineer.

7.26.24.5 Report

The result of the tests shall be reported to the Engineer without delay.

7.26.24.6 Control of Concrete by Compressive Strength

- (1) Control of concrete by compressive strength shall generally be based on 28 days compressive strength. Specimens, in this case, shall be taken in such a manner that they will represent the concrete of the structure.
- (2) Test results of compressive strength to be used for the control of concrete shall generally be obtained by averaging the compressive strength specimens taken from the same batch.
- (3) Should the quality of concrete be controlled by the test results, it shall be used for the control test.

7.26.24.7 Inspection of Quality of Concrete

- (1) The contractor shall submit to the Engineer the results of Inspection of Quality of concrete obtained according to the quality control test in the preceding Paragraph

8.16.6 and obtain approval of the Engineer.

- (2) Should it be found in the inspection that the quality of the concrete is not suitable, remedial measures such as modifying the mix proportions, performance tests of equipment's and facilities, improvement of the working method, etc. shall be taken. The concrete placed in the structure shall be checked if it can perform the designated function and the suitable measures, should it become necessary as directed by the Engineer.

7.26.24.8 Inspection of Structures

Structures shall be inspected after their completion as directed by the engineer.

7.26.24.9 Brick Masonry Work

Prior to commencing the brick masonry work, the surface of brick shall thoroughly be cleaned and sufficiently moistened in order to ensure smooth adherence of mortar to the brick surface.

7.26.24.10 Road Work

The Construction work of roads shall be carried out in accordance with the Drawing.

However, demolition and restoration of the public roads (including private roads) shall be carried out according to the specifications designated the official in charge of road management not with standing the provisions described in the specifications and the Drawing.

7.26.24.11 Road Work Inside the Premises

(1) Sub –grade

- a) Any excavation and banking work required for sub-grade construction shall be carried out in accordance with the respective provisions in General Provision SECTION-2 :
EARTH WORKS.
- b) The material required for banking and displacement shall be so placed that the finished thickness of one layer after compaction will become 20 cm or less.
- c) The sub-grade surface shall be finished by proof- rolling in order to obtain the contact pressure sufficient to permit smooth traffic of vehicles of 8 tons or over should any defects be detected as a result of proof-rolling, such defective sub-grade surface shall be finished again to the satisfaction of the Engineer.
- d) The finished sub-grade surface shall be within + 5 cm of the design elevation.

(2) Sub base Course

- a) The materials to be used for sub base course shall be in accordance with the specification described in the Drawing. The Contractor shall submit a report concerning the quality of materials and the methods of sampling to the Engineer for approval.

- b) The finished surface of sub base course shall be within –10 mm and + 5mm of the design elevation.

(3) Surface Course (Asphalt pavement)

- a) Prior to commencing pavement, the sides of concrete side walk, manhole, etc. shall be cleaned, and molten asphalt, etc. shall be coated over the sides.
- b) The surface to be seal-coated and prime-coated shall be finished into even level, and after perfecting removing any bloc, dust and other foreign matters, such surface shall be cured and dried.
- c) The mixtures shall be spread uniformly, rolled and finished into the specified thickness. Then, the finished surface shall be measured in parallel to the center line of the road by using a 3 m straight line ruler. In this case, the depth of any concave sections shall not exceed 5 mm.
- d) The Contractor shall submit a report on the materials to be used for pavement of surface course and method therefore to the Engineer for approval.

(4) Inspection

The Contractor shall receive inspection of the Engineer during the course and after completion of sub base course and surface course works.

7.26.24.12 Public Road (Including Private Road)

(1) Demolition of Pavement

Demolition of Pavement for public roads including private roads shall be carried out so carefully as not to cause any hazardous effect upon the surrounding portions of cement, concrete or pavement.

(2) Road Keeping and Restoration

- (a) The road keeping shall be of a construction applicable to the prevailing site conditions and so provided as not to cause any danger or trouble against traffic.
- (b) The contractor shall submit the drawings for road keeping to the Engineer for approval.
- (c) The Contractor shall constantly patrol any spots of road keeping and exert his utmost efforts perform maintenance and repair of such roads in order to eliminate any trouble against smooth traffic.
- (d) The Contractor shall carry out maintenance and repair of any pertinent roads so carefully as not to cause any trouble against smooth traffic until the said roads have been restored and taken over to the official in charge of road management.

7.26.24.13 Drainage Work



- (a) The drainage work shall be as described in the Drawing and carried out in accordance with General Provision SECTION-2 : EARTH WORK AND SECTION-3 : REINFORCED CONCRETE WORK.
- (b) The water – plumbing facility for drainage shall be of such a construction as not to cause any trouble against the surrounding area and structure. The contractor shall submit the design and execution schedule for the water plumbing work to the Engineer for approval.

7.26.25 Painting Work

7.26.25.1 General

This clause covers all painting applied to surface of plaster wood, and metal indicated in the Drawing. No painting shall be applied to surfaces of stainless steel copper, bronze, brass or any/all steel in contact with concrete. Painting work shall be performed by skilled workmen. Selection of color shall be as determined by the Engineer, unless otherwise specified.

7.26.25.2 Materials and Painting Coat

7.26.25.3 Materials

Materials to be used in this clause shall be as follows and shall conform
PAINTS AND VARNISHES

- **Water Based Paints**

Water based paints shall conform to the following standards:

BDS 500:1965	Specification for Distemper Dry (under revision);
BDS 1097:1984	Specification for Plastic Emulsion Paint. Part I for Interior Use; Part 2 for Exterior Use;
IS 5410-1969	Specification for Cement Paint, Colour as Required;
IS 428-1969	Specification for Distemper, Oil Emulsion, Colour as Required

- **Ready Mixed Paint and Enamels**

Ready mixed paints and enamels shall conform to the following standards:

BDS	13:1960 Specification for Ready Mixed Paints, Varnish, Lacquers and Related Products (under revision);
BDS	14:1960 Specification for Black Bituminous Paint, Brushing for General Purposes (under revision);
BDS 397:1964	Specification for Ready Mixed Paint, Brushing, Red Oxide Zinc Chrome, Priming (under revision);
BDS	398:1964 Specification for Ready Mixed Paint, Spraying, Red Oxide Zinc Chrome, Priming (under revision);
BDS 399:1964	Specification for Aluminum Paint, Spraying for General Purposes, in Dual Container (under revision);
BDS	400:1964 Specification for Aluminium Paint, Brushing, for General Purposes in Dual Container (under revision);

BDS	401:1964	Specification for Varnish, Finishing, Exterior, Type-I, (Synthetic) (Tentative) (under revision);
BDS 402:1989		Specification for Ready Mixed Paint, Brushing, Finishing, Semigloss, for General Purposes (First Revision);
BDS 499:1965		Specification for Ready Mixed Paints, Brushing, for Road Marking (white, yellow and black) (under revision);
BDS 616:1966		Specification for Enamel, Brushing, Exterior (i) Undercoating, (ii) Finishing, Colour as Required (under revision);
BDS 617:1966		Specification for Enamel, Brushing, Interior (i) Undercoating, (ii) Finishing, Colour as Required (under revision);
BDS 926:1980		Specification for Ready Mixed Paint, Brushing, Petrol Resisting, Air Drying, for Exterior Painting of Containers, Colour as Required;
BDS 927:1980		Specification for Ready Mixed Paint, Brushing, Petrol Resisting, Air Drying, for Interior Painting of Tanks and Containers, Red Oxide (colour unspecified);
BDS 928:1980		Specification for Ready Mixed Paint, Brushing, Acid Resisting, for Protection Against Acid Fumes, Colour as Required;
BDS 973:1981		Specification for Specification and Methods of Test for Linseed Stand Oil for Paints and Varnishes;
BDS	974:1981	Specification and Methods of Test for Raw Tung Oils for Paints and Varnishes;
BDS 1005:1981		Specification for Ready Mixed Paint, Brushing, Finishing, Stoving, Enamel, Colour as Required;
BDS	1141:1986	Specification for Ready Mixed Aluminium Priming Paints for Woodwork;
BDS	1151:1986	Specification for Pavement Marking Paints.

Thinners and Solvents

These shall conform to the following standards:

IS 324-1959	Specification for Ordinary Denatured Spirit (revised);
IS 533-1973	Specification for Gum Spirit of Turpentine (Oil of Turpentine) (First Revision);
IS 82-1973	Methods of Sampling and Test for Thinners and Solvents for Paints (First Revision).

Varnishes and Lacquers

These materials shall conform to the following standards:

BDS	401:1964	Specification for Varnish, Finishing, Exterior, Type-I, (synthetic) (under revision);
BDS	1064:1983	Specification for Varnish, Staving;
BDS	1065:1983	Specification for Varnish, Acid Resisting;
BDS	1066:1983	Specification for Varnish, Finishing, Interior;

IS 197-1969	Methods of sampling and Test for Varnishes and Lacquers (First Revision);
IS 340-1978	Specification for Varnish, Mixing (First Revision);
IS 346-1952	Specification for Varnish, Spirit, Clear, Hard;
IS 347-1975	Specification for Varnish, Shellac for general purposes (First Revision);
IS 348-1968	Specification for French Polish (First Revision);

7.26.25.4 Painting Coat

Number of coats shall be as indicated in the table below.

<u>Number of coats</u>				
<u>Material to be painted</u>		<u>Primary</u>	<u>Secondary</u>	<u>Finishing</u>
Steel	Outdoor	2	2	1
	Indoor	2	1	1
Wood	Outdoor	1	2	1
	Indoor	1	1	
Concrete Plaster and board	Outdoor	1	2	1
	Indoor	1	1	1
Acid – proof	Indoor	1	3	1
Galvanized steel	Outdoor	2	1	1
	Indoor	1	1	
Touch –up of galvanized steel		1	1	1

7.26.25.5 Workmanship

- (1) Smooth Finished & soft colored Plastic paint should be used over the Plastering work of interior wall and ceiling.
- (2) Smooth Finished & Architectural approved colored weather coat should be used over the Plastering work of Exterior wall. Some where should be used Ceramic Facing brick (Strip)/ Rustic Tiles as per direction/decision of Architecture or approved 3D view.
- (3) Painting shall be applied by spraying, brushing or rolling.
- (4) Surfaces to be painted shall be smooth, dry and free from dirt, loose mill scale, rust, grease, or other deleterious material
- (5) The contractor shall submit the samples and catalogue of paint of the Engineer for approval.

7.26.25.6 Protection

Drop clothes shall be furnished and place to fully protect all parts or work during execution of the contract. The Contractor shall be held responsible for paint droppings on cement floor

and base.

Paint droppings shall be entirely removed, and damaged surfaces shall be repaired in a manner satisfactory to the Engineer.

No work shall be accepted which shows laps. Stains, flat or glossy spots or imperfections in surface over which paint or other finish is applied.

All rubbish, waste, or surplus materials shall be removed from time to time, and all woodwork, hardware, floors or other adjacent work shall be cleaned.

All glass throughout the building shall have all paint or varnish spots and brush marks removed, and upon completion of the painting work, all glass that is scratched or damaged by the painter's work, shall be replaced at the contractor's responsibility.

Hardware and other unpainted metal surfaces shall be cleaned.

7.26.26 CONTROL BUILDING

7.26.27 Temporary Work, Earth Work and Piling Work

7.26.27.1 General

The work of the above items shall be specified in clauses "TEMPORARY WORK", "EARTH WORK" and "PILING WORK" in Section 1 "GENERAL PROVISIONS", unless otherwise specified.

7.26.27.2 Materials of Pile

The pile to be used for Control Building shall be RCC.

7.26.28 Concrete Work

7.26.28.1 General

Concrete work shall be as specified in Clause "CONCRETE WORK" in SECTION 1 "GENERAL PROVISIONS", unless otherwise specified.

7.26.28.2 Classification of Materials to Be Used for Buildings

7.26.28.3 Concrete

The classification to be used for structural concrete shall be 4 Fc = 210 kg/cm² concrete. (class E 210-10-25)

The classification to be used for leveling concrete shall be 4 Fc = 120 kg/cm² concrete. (class C 120-10-40)

7.26.28.4 Reinforcing Bar

Reinforcement and welding of reinforcement to be placed in concrete shall conform to the requirements of this section.

- a) Deformed Reinforcement : Deformed reinforcing bars shall conform to the following standards; BDS 1313, Steel Bars and Wires for Reinforcement of Concrete; BDS 580, Rolled Deformed Steel Bars (intermediate grade) for Concrete Reinforcement; Reinforcement conforming to the ASTM, Standards: A615M, Deformed and Plain Billet-Steel Bars; A616M, Rail-Steel Deformed and Plain Bars; A617M, Axle-Steel Deformed and Plain Bars; A706M, Low-Alloy Steel Deformed Bars; A767M, Zinc Coated (Galvanized) Steel Bars; and A775M, Epoxy-Coated Reinforcing Steel.
- b) Deformed reinforcing bars with a specified yield strength (f_y) exceeding 410 MPa may be used, provided f_y shall be the stress corresponding to a strain of 0.35 per cent and the bars otherwise conform to ASTM standards noted above. Fabricated deformed steel bar mats conforming to ASTM A184M and deformed steel wire complying with ASTM A496 may be used. Deformed wire for concrete reinforcement shall not be smaller than size D4 (Nominal diameter : 5.72 mm), and for wire with a specified yield strength f_y , exceeding 410 MPa f_y shall be the stress corresponding to a strain of 0.35 per cent.
Welded deformed steel wire fabric conforming to ASTM A497 may be used; for a wire with a specified yield strength (f_y) exceeding 410 MPa, f_y shall be the stress corresponding to a strain of 0.35 per cent. Welded intersections shall not be spaced farther apart than 400 mm in direction of calculated stress, except for wire fabric used as stirrups.

7.26.28.5 Form

7.26.28.6 Form Oil

Form oil shall be light colored paraffin oil or other acceptable non-staining material. Form in contact with concrete shall be given a uniform light spray coating of the specified form oil coating in accordance with the manufacturer's recommendations. Form coating shall be applied to the forms before they are set.

7.26.28.7 Form Ties

Form ties shall have sufficient strength, stiffness and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. The type of form ties used shall be submitted to the Engineer for approval.

7.26.29 Steel Reinforcement

7.26.29.1 Lapped Splices in Reinforcement

Splices at points of great stress shall be avoided wherever possible, and care shall be exercised to avoid concentration of splices at one place.

a) Length of Lap

The lengths of laps in lapped splices shall be in accordance with the Drawings and indicated below.

40 d without hook
35 d with hook

The length of lap in a lapped splice of reinforcing bars of different diameters shall be based on the nominal diameter of smaller bar.

7.26.29.2 Anchorage of Reinforcement

The length of anchorage of reinforcement shall be determined in accordance with the type of reinforcing bar, the grade of concrete and type of stress acting on the reinforcement, and shall be as indicated in the table below, unless otherwise indicated.

Length of Anchorage of Reinforcement

Re-Bar	Strength of Concrete Ordinary Concrete		Length of Anchorage Lower Bar Beam	Floor, Roof
SD30	210kg/mc2	35 d or 25 d with hook	25 d or 15 d with hook	10 d and 15 cm or more

Note : “d” denotes nominal diameter of reinforcing bar.

7.26.29.3 Dowels

Dowels shall be installed at right angles to construction joints. Dowels shall be accurately aligned parallel to the finished surface and shall be rigidly held in place and supported during placing of the concrete.

7.26.29.4 Concrete Protection for Reinforcement

The thickness of concrete cover for reinforcement shall be determined to provide necessary fire resistance, durability and bearing strength of the member. Minimum concrete cover shall be provided in accordance with the table below.

Table : Minimum Thickness of Concrete Cover for Reinforcement

Item	Structure Element		Covering Thickness (cm)	
	Floor, Wall	Covered finish	2	
		Uncovered	3	
		Interior finish	3	
Part not		Uncovered	3	
Contacting Column, Beam wall Ground		Exterior, covered finish	3	
		Uncovered	4	

	Bearing wall		4	

Table : Minimum Thickness of Concrete Cover for Reinforcement (Cont'd)

Item	Structure Element		Covering Thickness (cm)	
		Wall, Column, beam, floor	4	
Part contacting ground		Foundation, retaining wall	6	

7.26.29.5 Concrete Test

The test of concrete shall be executed as follows:

- The concrete tests, necessary to maintain the quality control of concrete, shall be executed and their test results shall be submitted to the Engineer.
- For concrete compressive tests, six (6) test specimens shall be required for each concrete placement.
- Three (3) specimens shall be tested for seven (7) or fourteen (14) days strength, the remaining three (3) specimens shall be test tested for twenty-eight (28) days strength.
- The test of concrete shall be executed once for each 150m³ or less of concrete to be poured on the same day.

The expense for the above tests shall be included in the unit prices.

7.26.29.6 Tolerances for Concrete Construction

Concrete structure shall be constructed to the line shown in the drawings.

Any structure which does not conform to such lines within the tolerances listed below shall be repaired, removed and made a new by the contractor.

Tolerances limits of concrete structure shall, as a standard, be in accordance with the table below.

Tolerance Limited

Type	Item		Tolerances against base line (mm)
Column, wall	A. Form	Architecturally formed	3
		Others	5
	B, Concrete surface		7

Beam, slab	A. Form		1
	B. Deflection		3
	C. Concrete surface		7
	A. Column line		3

7.26.29.7 Steel Thrown Finish

After the placing of concrete has been completed, steel trowel finish shall be applied to interior concrete floors, such as bed of vinyl asbestos tile and exposed steel trowel finish floor as indicated in the drawings.

The finished floor surfaces shall be true plane surfaces with no deviation in excess of 3.0mm when tested with a 300mm.

Surfaces shall be pitched to drains where indicated in the drawings.

Instead of hand finishing, the contractors may use an approved power finishing machine provided that the finished surfaces are free of machine marks or ridges.

7.26.29.8 Concrete Surfaces to Be Exposed

Form surfaces that will be in contact shall be of material that is non-reactive with concrete and that will produce concrete surfaces equivalent in smoothness and appearance to that produced by new plywood panels.

Smaller size panels shall be used only where required by openings or joint details, with each area less than 120 cm wide formed with a single panel accurately cut to the required dimensions.

Cut surfaces shall be smooth and treated with form coating. Panel joints that will be in contact with concrete shall be smooth and free of offset.

Form materials with defects that will impair the texture and appearance of finish surfaces shall not be used.

Column forms shall be made with a minimum number of joints.

7.26.30 Masonry Work

7.26.30.1 Concrete Block Masonry

7.26.30.2 General

This clause covers walls, partitions and lintels constructed with pre-cast concrete hollow blocks reinforced with steel bars.

7.26.30.3 Materials

1) Cements and aggregate

Cement and aggregates to be used in the concrete hollow block shall be as specified in the clause "REINFORCED CONCRETE WORK". Coarse aggregate for blocks shall not be larger than one-fifth (1/5) of the narrowest

- with of hollow block section.
- 2) Cement mortar and concrete

Reinforcing bars shall be as specified in the clause “ REINFORCED CONCRETE WORK”

- 3) Cement mortar and concrete

Standard mix proportion shall be as follows, unless otherwise shown:

	Work	Mix proportion (by volume) Cement : (slaked lime) : sand
	For masonry Joint	1 : 3
Cement mortar	For Tamping	1 : 3
	For painted joint	1 : 3
Concrete	For Tamping	1 : (2.5) : 3.5

7.26.30.4 Working Drawings

Working drawings of the block laying plan including reinforcing for arrangements and the places of anchor bolts shall be submitted to the engineer for approval.

7.26.30.5 Application Method

- 1) Reinforcing Bars

Unless otherwise specified, reinforcing bars shall be of D10, and shall be placed at three (3) block intervals horizontally and two (2) block intervals vertically.

Intersection of the bars shall be securely tied with wire. The extra reinforcing bars to be used for the perimeters of the opening shall be of D 13.

- 2) Laying

The concrete surface to receive blocks shall be cleaned and thoroughly wetted prior to laying the masonry units. All masonry units shall be clean and free from surface dust before laying, and shall be laid by using cement mortar.

Fractional parts of units will not be permitted where whole units can be used. Joints shall be 10mm thick, and as uniform as possible.

All exposed joints shall be raked 10mm deep and tooled firmly so as to produce a smooth, tight surface. All cell where reinforcing bars are inserted and blocks are jointed shall be compactly filled with specified mortar (tamping mortar).

Laying of blocks shall not exceed 1.2 meters per day in height.

Pipes and conduits to be inserted in the concrete hollow block walls shall be embedded in such a manner as not to cause any damage to the block. The contractor shall coordinate placing of all items embedded in masonry, and shall be responsible for any changes in positions.

7.26.30.6 Lintel

Lintels for opening shall be of reinforced concrete and extended to a length of at least 20mm into the adjoining walls.

All cells of the blocks directly below the extended lintels shall be filled with mortar.

7.26.30.7 Bond Beam

When the height of concrete block wall exceeds 30 times the wall thickness, reinforced precast or pour in place concrete bond beam shall be provided at each 30 times exceeding the wall thickness.

7.26.31 Precast Concrete Block

7.26.31.1 General

Materials, such as cement, aggregate, reinforcing bars, etc. shall be as specified in the Clause "REINFORCED CONCRETE WORK"

Maximum size of coarse aggregate shall be less than 5mm. Specific gravity of coarse aggregate shall be 2.7 or more, unless otherwise specified.

Mix proportion of cement, sand : coarse aggregate shall be 1:2:4, respectively.

7.26.31.2 Lightweight Concrete Block for Roofing

Specific gravity of coarse aggregate for lightweight concrete shall be 1.7.- 1.9.

7.26.32 Water Proofing Work

7.26.32.1 General

This clause covers all waterproofing, built up roofing and mortar waterproof.

7.26.32.2 Built Up Roofing

7.26.32.3 Materials

(1) Asphalt Primer

Asphalt primer shall be applied by spraying or brushing. The quality of material shall be in accordance with the table below:

Drying Time	Not less than 8 hours
Remainder after drying	Not less than 35%
Specific Gravity	Less than 1.0

Test method for the above shall comply with JIS K 5400 or equivalent BDS

(2) Asphalt Compound

The quality of materials shall conform to ASTM, and shall in accordance with the table below.

	Asphalt Compound
Penetration (25 °C, 100 gr, 5 sec.)	20 – 30 (2.0 ~ 3.0 mm)
Softening Point °C	Not less than 90 °C
Carbon disulfide	Not less than 97%
Matteability (25 °C)	Not less than 2.5mm
Volume of Evaporation	Less than 0.5%
Penetration after evaporation	Not less than 70%
Flashing Point (open cup method)	Not less than 230 °C
Specific Gravity	1.01 - 1.04

(3) Asphalt Roofing

Asphalt roofing shall comply with JIS A 6006 (Asphalt Roofing Felts), or equivalent BDS and shall be 45kg. – item (21.0m x 1.0 m per roll)

The Contractor shall submit sample of asphalt roofing to the engineering for approval.

- (i) Specific roofing shall, in principle, consist of copper mesh (#38) or glass-fiber (#23) coated with asphalt, and the weight of standard item shall be 55kg.
- (ii) Perforated Roofing

Quality of material shall comply with JIS A 6006 or equivalent BDS. The Contractor shall submit the sample to the engineer for approval.

7.26.32.4 Grades of Water Proofing

Working Process	Class – A	Class - B
1	Asphalt Primer (0.31/m ²)	Asphalt Primer (0.31/ m ²)
2	Perforated roofing within layer of sand	Asphalt (0.1 kg/ m ²)
3	Asphalt (1.2 kg/ m ²)	Asphalt Roofing
4	Special roofing	Asphalt (1.0 kg/ m ²)
5	Asphalt (1.0 kg/ m ²)	Special roofing
6	Special roofing	Asphalt (1.0 kg/ m ²)
7	Asphalt (1.0 kg/ m ²)	Asphalt roofing
8	Asphalt roofing	
9	Asphalt (2.0 kg/ m ²)	

Class – A shall be applied for the roof. Class – B shall be applied for the lavatory.

Inclination of the base concrete shall be, in principle, more than 1/100.

7.26.32.5 Application Method

Asphalt primer shall be evenly sprayed over the base concrete or roof insulation board. Asphalt compound shall then be vinyl poured and spread over the asphalt primer. Compound heated to a temperature exceeding 230°C shall not be used.

In the case of class – A, perforated roofing shall be laid between asphalt primer and asphalt compound.

Asphalt felt, roofing and special roofing shall be flatly laid over each respective asphalt compound. The sides and ends of these sheets shall be provided with an overlap of at least 9 centimeters. The joints shall be completely water tight and not be concentrated.

Care shall be exercised for the roofing works surrounding anchor bolts, parapets and roofdrains to prevent any leakage.

7.26.32.6 Mortar Waterproofing

The waterproofing agent shall be used for mortar waterproofing of roof and balcony.

Cement and sand to be used for waterproofing mortar shall be as specified in the clause
“PLASTER WORK”

The catalogue and mix proportion shall be submitted to the Engineer for approval.

The application method of mortar shall be as specified in the clause “PLASTER WORK”

7.26.33 Caulking

7.26.33.1 General

The Contractor shall furnish all materials, labor and equipment necessary to complete the work as specified or as directed by the engineer.

The contractor shall submit the catalogues and work procedures to the engineer for approval.

7.26.33.2 Material

- (1) Oil caulking compound shall conform to JIS A 5751 (Oil Based Caulking compounds Buildings) or equivalent.
- (2) Thiokol caulking shall conform to JIS A 5754 (Polysulfide Sealing compound for Buildings) or equivalent.
- (3) Thiokol caulking shall be used as joint for all surroundings of exterior doors, windows

and concrete panels.

7.26.33.3 Workmanship

All joint surfaces to be filled shall be sound, clean and dry. All concrete surfaces shall be fully cured before application of caulking.

Joint surfaces to be filled shall be primed with the manufacturer's recommended primer, compatible with the Thiokol base sealing compound and appropriate for the surfaces to be sealed.

Mixing and application of filling compound shall be in accordance with the manufacturer's recommendations, and shall be submitted to the engineer for approval.

All filler work shall be done by skilled workmen.

7.26.33.4 Control Joint For Roof

Control joint shall be provided between mortar finish and light weight concrete block and at about 4.0mm of intervals in light weight concrete block area of roof.

Control joint shall consist of elastight and asphalt mortar.

7.26.34 Tile Work

7.26.34.1 General

This clause covers all works required for mosaic tile, ceramic tile and others applied on floors and wall.

Working drawings shall be submitted to the engineer for approval.

Prior to starting work, the contractor shall submit samples of tile to the Engineer for approvals.

7.26.34.2 Materials

7.26.34.3 Floor Finish

- To be used 600mmx600mm (24 inch x 24inch) size European standard Mirror Polished Homogeneous tiles for 1st to 6th Floor.
- For Ground/Underground Floor finish to be used as per Transformer based design such as use dry gravels for bottom of the Transformer and Rustic Tiles for walk way or common space. Materials to be used in the works shall be high quality, high grade and good appearance.

7.26.34.4 Ceramic Tile for Interior Wall Finish (GWI) for Bath room's wall

Special color and size of European standard Ceramic Tile with decorative Boarder shall be used in Bath rooms & other necessary interior walls.

Materials to be used in the work shall be high quality, high grade and good appearance.

7.26.34.5 Ceramic Tile for Exterior Wall Finish

Ceramic tile for exterior wall finish shall be of 60mm x 227mm, colored, glazed and manufactured by qualified manufacturer as approved by the engineer. (if required)

The color of tile shall be designated by the engineer.

7.26.34.6 Setting Materials

- (1) Cement, sand to be used for mortar bed shall be as specified in the clause “REINFORCED CONCRETE WORK”
- (2) Bedding mortar shall be mixed with one part Portland Cement and three parts sand.

7.26.34.7 Setting

- (1) Mosaic Tile

The mortar setting bed shall be floated to a uniform plumb and level surface to bring the finish surface to the required plane.

Thickness of mortar shall be about 10 millimeters.

Mosaic sheets shall be placed in positions on the pure coat and freshly combed into the mortar setting bed with trowel. Sheets shall be tamped firmly into place and made true and even with the finished surface line or plane.

Expansion joints or control joints at 6 meters on center shall continue through the mortar bed and mosaic tile and shall be kept free from mortar and grout. Those shall be filled with an approved caulking compound and shall be as close as possible to the color of the grout mortar. All joints, after removal of the paper, shall be grouted leaving them completely and uniformly filled. At no time shall sand or any abrasive be used that will damage the natural sheen of the mosaic tile. All excess grout and glue shall be removed from the face of the tile leaving the finished surface clean.

- (2) Ceramic Tile

Laying of ceramic tile shall comply with the specifications for “Mosaic Tile” for floors, tile lay out work shall begin from the center lines of areas to eliminate use of half tiles.

For walls, tile layout work shall begin from the top of the wall and proceed downward.

Tile shall be soaked in clean water for at least one hour prior to setting and applied to setting bed within five minutes after soaking.

- (3) Protection

The contractor shall provide and install barriers or other forms of protection and covering to prevent damages.

(4) Cleaning

Tiles shall be thoroughly cleaned after grouting and painting has sufficiently set. A;; traces of cement or foreign matter shall be removed from tiles. Exposed hardware and plumbing trim shall be covered with baseline during tile setting. Base line shall be removed and metal shall be cleaned and polished.

7.26.34.8 Gun Sprayed Tile

Gun sprayed tile shall be applied on the surface of concrete as indicated in the drawings. Gun sprayed tile shall conform to JIS A 6910 - C or equivalent. Sealer shall be applied on the concrete surface so as to prevent moisture from main material and to increase adhesion of main material. Main material shall consist of white Portland Cement, dolomite plaster and coloring agent. The color shall be designated by the Engineer.

7.26.35 Metal Works

7.26.35.1 General

This clause covers all metal works for flooring, siding, walling, flushing, railings, roofing, raiser, plumbing, and other pertinent fixtures. The contractor shall submit fabrication and installation drawings to the engineer for approval.

7.26.35.2 Handrails

7.26.35.3 Steel Railings

For Stair case railing to be used Stainless Steel Pipe, Square Box & other decorative post as per drawing to the engineer for approval.

Steel railings, including pipe inserts to be embedded in concrete shall conform to JIS G 3452 and shall be galvanized, unless otherwise specified.

Square pipe shall be of the size indicated in the Drawings.

Galvanizing coat damaged by bolting, welding and other field works shall be repaired and painted with two coats of silver zinc paint.

7.26.35.4 Fabrication

Mitered and welded joints shall be made by fitting post to top rail and intermediate rail to post mitering comers, groove welding joints, and grinding smooth.

Railings may be bent at comers instead of jointed, provided that the bends are made in suitable jigs and that the pipe is not crushed or damaged.

Edge of the railings shall be covered with steel plates.

7.26.35.5 Installation

Rails shall be installed by means of steel sleeve inserts which shall be seat and anchored in

the concrete.

Ports shall be inserted into the galvanized steel sleeves embedded in concrete or shall be welded to the stringer, beam or toe plate made level, perpendicular and aligned.

The space between pipe posts and pipe sleeve inserts except those marked “Removable handrail” as indicated in the drawings shall be filled solid with molten lead or shall be welded.

7.26.35.6 Steel Ladders

Materials to be used for steel ladders shall conform to JIS G 3101 – SS 41 or equivalent.

Steel ladders shall be fabricated of 1- 65 x 6 steel angle stringers and 19mm diameter steel bar rungs. Rungs shall be spaced 350mm apart and shall be inserted into the stringers and welded thereto.

The ladders, including welded on bracket, shall be pointed.

7.26.35.7 Corner Guards

Corner guards for jumps, where directed by the engineer and sills of opening and edges of concrete column and wall shall be of steel angles or steel plates, conforming to JIS G 3101-SS 41 or equivalent, anchored into concrete with welded steel straps or end weld stud anchors.

7.26.35.8 Stair Safety Nosing for Concrete Stair

Stair safety nosing shall be of extruded bronze or stainless steel with cross hatched nosing. Safety nosing shall be provided with integrally cast or bent anchors for embedding into concrete.

7.26.35.9 Divider Strips

Divider strips shall be half hard brass and shall be placed between different types of floorings as indicated. Divider strips shall be secured to floors by strip anchors or by flat head countersunk brass screws set in lead plugs.

7.26.35.10 Roof Drain

Roof drains shall be of cast iron baked with refined tar and shall conform to JIS A 5511, or equivalent, The size shall be in accordance with the drawings.

7.26.35.11 Corner Bead

Corner bead shall be half hard brass, and shall be placed at edges of columns and wall where mortar or plaster is applied.

7.26.35.12 Blind Box

Blind boxes shall be provided above all windows faced to outdoor, excepting for lavatory, storage, janitorial, kitchen and rooms which located on the first floor.

They shall be constructed of 1.6mm thick steel plate conforming to JIS G 3131, JIS G 3141

orequivalent and shall be painted.

Hanger bracket for installation of the blind box shall be galvanized 6mm thickness flat bar conforming to JIS G 3101 SS 41 and shall be installed at spacing of 90cm diameter expansion blots.

Connection between blind box and hanger bracket shall be 6mm diameter bolts and nuts.

7.26.35.13 Doorsill

Prior to commencement of floor finish work, doorsill shall be provided in place between different types of flooring, unless otherwise indicated, and shall be stainless steel conforming to JIS G 4305 – SUS 304 or equivalent.

7.26.35.14 Flashing Plate

Flashing Plates shall be of 2.3mm galvanized steel plate conforming to JIS G 3131, G 2341 or equivalent.

Flashing plates shall be provided at wall and roof opening for piping and at surrounding areas of windows, louvers rolling doors and doors facing outdoors.

7.26.35.15 Embedded Plate, Hook and Sleeve

The contractor shall provide plates, hooks and sleeves to be embedded in concrete as required.

Embedded plates, hooks and sleeves shall have sufficient thickness, diameter and anchorage in order to fix equipment, piping and other necessary items. Painting shall be applied on the plates and hooks after fixing the equipment and piping.

The materials to be used for plates, hooks and sleeves shall conform to JIS G 3101 SS 41 or equivalent.

7.26.35.16 Joiner

Joiners shall be provided at surrounding space of suspended ceilings and shall be of aluminum conforming to JIS H 4000 or equivalent.

Small screws shall be of stainless steel or of high strength aluminum alloy.

7.26.35.17 Down Spout

Downspouts to be used for drains shall be steel pipe conforming to JIS G 3442 or equivalent.

Metal bracket shall be of 50mm x 4.5mm steel plate conforming to JIS G 3101 SS 41 or equivalent and galvanized.

Downspouts shall be fixed with metal brackets at maximum of 2.0m per space.

7.26.36 Plaster Work

7.26.36.1 General

7.26.36.2 Treatment of Bed

- (1) Concrete surfaces which are too smooth to receive plastering shall be roughened beforehand with chisels.
- (2) Where wall and floors of concrete, concrete block, etc. are distorted or uneven, the bed shall be repaired with mortar.

7.26.36.3 Cleaning and Wetting of Bed

The bed, scratch coat, and treated surface of bed shall be cleaned and suitably wetted before application of the following coat. Portions of the base or coated surface which are not bonded shall be immediately repaired.

7.26.36.4 Curing

In order to prevent soiling and premature drying of plastered surface, window and door work shall be completed prior to commencement of the plaster work sheet coverings provided and sprinkling of water performed.

In order to prevent the soiling of neighboring members and other finished surface, suitable protections shall be provided using paper, boarding, tarpauling sheet or other suitable means.

7.26.36.5 Mortar Plastering

7.26.36.6 Materials

- (1) Cement shall conform to JIS R 5210 ordinary Portland Cement or locally produced equivalent.
- (2) Sand shall be of good quality free of salts, mud, trash and /or organic matters. The gradations shall be in accordance with the table below.

Table Gradation of Sand

Gradation (by weight)	Type of Mortar
Plastering	
Passing 5mm sieve.....100%	First coat ad
second coat	
Passing 0.15mm sieve not more than 10%	
Passing 2.5mm sieve.....100%	Finish coat
Passing 0.15mm sieve.....not more than 10%	

Water shall be clean and free of sales, iron, sulfur and/ or organic matter, as specified in he clause

“CONCRETE WORK”.

7.26.36.7 Mixing

The mix proportions of mortar shall be of standard type in accordance with the table below.

Table Mix Proportion (by Volume)

Base	Portion to be Plastered	First Coat	Second Coat	Finish Coat	
		C : S	C : S	C : S	Slaked Lime
	Floor			1 : 2	
	Interior Wall	1 : 2	1 : 3	1 : 3 : 0.3	
Concrete	Ceiling	1 : 2		1 : 3 : 0.3	
Concrete Block	Exterior Wall and Others	1 : 2	1 : 3	1 : 3	
Wire lath	Interior Wall	1 : 3	1 : 3	1 : 3 : 0.3	
Metal Lath	Ceiling	1 : 2	1 : 3	1 : 3 : 0.3	
	Exterior wall and Others	1 : 3	1 : 3	1 : 3	

In the above table, abbreviated C and S mean cement and sand, respectively.

7.26.36.8 Plastering Thickness

The thickness of application shall be in accordance with the standards indicated in the table below.

Table Plastering Thickness

Bed	Portion to be plastered	Plastering Thickness (mm)				Total
		First coat	Dubbing Coat	Second Coat	Finish Coat	
	Floor	-	-	-	30	30
Concrete	Interior wall	6	5	6	3	20
Concrete Block	Exterior wall	6	7	6	6	25
	Ceiling, others	4.5	-	4.5	3	12
	Interior wall	7.5	-	7.5	3	18
Wire Lath	Exterior wall	6	-	7.5	3	18
Metal Lath	Ceiling, waves	4.5	-	4.5	3	12

7.26.36.9 Application Method

(1) First Coat and Dubbing Out

Mortar shall be trowled on adequately to leave on conspicuous hollow. The surface of the first coat shall be roughened with tools such as metal combs.

The first coat shall be left standing for not less than 10 days allowing cracks to be fully developed before applying the next coat.

Dubbing out for concrete and concrete block shall be performed by roughening with tools such as metal combs and shall be left standing for not less than 5 days.

(2) Second Coat

For the second coat, a ruler shall be provided at external corners, internal corners and edges applied on order to attain an even finish.

(3) Finish Coat

The finish coat shall be applied in a manner so as to be blemish free by watching the degree of drying of the brown coat and by paying special attention to the surface, angles and edges.

The finish shall be either steel troweled, wood troweled or brushed as directed by the engineer.

For the exterior wall, the mortar shall first be troweled on with a wood trowel, then furnished with a steel trowel and finally brushed avoiding use of water as much as possible.

(4) Floor Mortaring

In the case of concrete which is several days old, concrete paste shall be buttered on in adequate quantity and spread out with brooms and the like after which application of mortar shall be started.

Application of mortar shall be performed using stiff mortar containing a minimum of water and the mortar shall be tamped to bring moisture to the surface. The mortar shall be screened while paying attention to the grade upon and then shall be troweled smooth.

The crack control joint should be provided at intervals of approximately 3.0m. The joints shall be tooled.

(5) Base for Tile Fixing

In the case of using adhesives of wall tile or mosaic tile, mortar application shall be to the second coat.

7.26.37 Plastering

7.26.37.1 Materials

Plaster shall comply with JIS A6904 (Gypsum Plaster) or equivalent. Cement which is more than six (6) months aged shall not be used.

7.26.37.2 Mix Proportion

The mix proportions shall be as follows :

Bed	Layer	Plaster				Applied Thickness	Wall
		For Finish	For Bed	Sand	White Fiber (g)/25kg	Ceiling	
Concrete and concrete block	2nd coat	-	1	2.0	250	6.0	7.5
	Finish coat	1	-	-	-	1.5	1.5

7.26.37.3 Application Method

The surface to receive gypsum plastering shall be leveled with a coat of cement mortar of which the mix proportion of cement and sand is 1:2 prior to the application of plaster and the leveled surface shall be scratched to insure satisfactory adhesion of the plaster. Before applying plaster, the receiving surface shall be prepared by removing all foreign substances and shall be dampened.

7.26.38 Doors, Windows and Louvers

7.26.38.1 Wooden Doors and Frames

7.26.38.2 General

This clause covers wooden doors and wooden frames, including finish hardware, such as butts, hinges, locks, knobs, stops, strikes, holders, door chains and closures.

7.26.38.3 Materials

All doors shall be flush type, of sizes as shown in the drawings. Materials shall be, in principle, locally principle, locally produced. Standard flush doors be double paneled door of 6mm thick plywood and shall have stiffening ribs spaced at intervals of 15cm. Plywood shall be banded to the frames with a suitable adhesive which shall conform JIS K 6801 and 6803 or equivalent.

Waterproofed plywood shall be used for wooden doors for the lavatory.

The waterproofed plywood shall be of 6mm thickness five (5) ply and the weight shall be 4.79 kg/m².

The each layer shall be completely pressed and adhered by using phonetic resin adhesives and the plywood shall be passed a boiling test and a dry and wet repeating test.

All wooden doors and frames shall be painted as specified in clause "PAINTING" unless otherwise specified.

7.26.38.4 Shop Drawings

The contractor shall submit stop drawings of fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installation, sizes, operation, methods of anchoring and any other pertinent details required for the installation thereof.

7.26.38.5 Wooden Door Frames

All frames shall be accurately set, plumb, level and shall be securely nailed to the wooden block embedded in the concrete or mortar. Door Frame and Shutter should be made by solid wood such as Burma Teak as per direction/decision of the employer

7.26.38.6 Installation

Each door shall be accurately cut, trimmed and fitted to its frame and hardware with allowance for paint finish and possible swelling or shrinkage. The clearance at the top shall not exceed 6mm.

7.26.38.7 Hardware for Wooden Doors

Hardware for wooden doors shall in principle be stainless steel conforming to The applicable standards are listed below :

BDS 113:1986	Specification for Latches and Locks for Doors in Buildings;
IS 204-78	Specification for Tower Bolts; Part I Ferrous Metals (Fourth Revision); Part II Nonferrous metals (Fourth Revision);
IS 205-1978	Specification for Nonferrous Metal Butt Hinges (Third Revision);
IS 206-1981	Specification for Tee and Strap Hinges (Third Revision);
IS 208-1979	Specification for Door Handles (Third Revision);
IS 281-1973	Specification for Mild Steel Sliding Door Bolts for Use with Padlock (Second Revision);
IS 362-1982	Specification for Parliament Hinges (Fourth Revision);
IS 363-1976	Specification for Hasps and Staples (Third Revision);
IS 364-1970	Specification for Fanlight Catch (Second Revision);
IS 452-1973	Specification for Door Springs, Rat-tail Type (Second Revision);
IS 453-1973	Specification for Double Acting Spring Hinges (Second Revision);
IS 729-1979	Specification for Drawer Locks, Cupboard Locks and Box Locks (Third Revision);
IS 1019-1974	Specification for Rim Latches (Second Revision);
IS 1341-1981	Specification for Steel Butt Hinges (Fourth Revision);
IS 1823-1980	Specification for Floor Door Stoppers (Third Revision);
IS 1837-1966	Specification for Fanlight Pivots (First Revision);
IS 2209-1976	Specification for Mortice Locks (vertical type) (Third Revision);
IS 2681-1979	Specification for Nonferrous Metal Sliding Door Bolts for Use with Padlocks (Second Revision);
IS 3564-1975	Specification for Door Closers (hydraulically regulated) (Second Revision);
IS 3818-1971	Specification for Continuous (piano) Hinges (First Revision);

IS 3828-1966	Specification for Ventilator Chains;
IS 3843-1966	Specification for Steel Backflap Hinges;
IS 3847-1966	Specification for Mortice Night Latches;
IS 4621-1975	Specification for Indicating Bolts for use in Public Baths and Lavatories (First Revision);
IS 4948-1974	Specification for Welded Steel Wire Fabric for General Use (First Revision);
IS 4992-1975	Specification for Door Handles for Mortice Locks (vertical type) (First Revision);
IS 5187-1972	Specification for Flush Bolts (First Revision);
IS 5899-1970	Specification for Bathroom Latches;
IS 5930-1970	Specification for Mortice Latch (vertical type);
IS 6315-1971	Specification for Floor Springs (hydraulically regulated) for Heavy Doors;
IS 6318-1971	Specification for Plastic Window Stays and Fasteners;
IS 6343-1982	Specification for Door Closers (pneumatically regulated) for Light Doors Weighing up to 40 kg (First Revision);
IS 6602-1972	Specification for Ventilator Poles;
IS 6607-1972	Specification for Rebated Mortice Locks (vertical type);
IS 7196-1974	Specification for Hold Fast;
IS 7197-1974	Specification for Double Action Floor Springs (without oil check) for Heavy Doors;
IS 7534-1974	Specification for Mild Steel Locking Bolts with Holes for Padlocks;
IS 7540-1974	Specification for Mortice Dead Locks;
IS 8756-1978	Specification for Ball Catches for use in Wooden Almirah;
IS 8760-1978	Specification for Mortice Sliding Door Locks, with Lever Mechanism;
IS 9106-1979	Specification for Rising Butt Hinges;
IS 9131-1979	Specification for Rim Locks;
IS 9460-1980	Specification Flush Drop Handle for Drawer;
IS 9899-1981	Specification for Hat, Coat and Wardrobe Hooks;
IS 10019-1981	Specification for Steel Window Stays and Fasteners;
IS 10090-1982	Specification for Numericals;
IS 10342-1982	Specification for Curtain Rail System
or equivalent.	

7.26.39 Steel Fittings

7.26.39.1 General

This clause covers steel fittings, including finish hardware, such as butts, hinges, locks, knobs, stops, strikes, holders, door chains and closures.

7.26.39.2 Materials

Steel sheet shall conform to JIS G 3131, G 3141 or equivalent.

The thickness of steel plates shall be as designated below, unless otherwise specified.

Door Frame 1.6 mm
Architrave 1.2 mm
Threshold 2.3 mm
Door Leaf Frame and flush plate 1.6 mm Stiffener and anchor plate 2.3 mm
Machine screws and rivets shall conform to JIS B 1101-1106, JIS B 1201-1205 and JIS B 1131-1133 or equivalent.

7.26.39.3 Steel Doors

Steel doors shall be single or double hollow core, single or double swing type or sliding type and with dimension and location as indicated in the drawings. All doors shall be complete with door frames, hard wares and any / all necessary accessories.

Shop fabricated frames without threshold shall be provided with temporary spreads at bottom to preserve proper shape during transportation and erection.

All metal surfaces shall be thoroughly cleaned and given two coats of rust inhibitive paint after being zinc plated in shop.

Field paint for finish shall be provided as specified in the clause "PAINTING"

7.26.39.4 Steel Louver

Steel louvers shall be of 45° slits and 100mm thick louvers and frame assembly. The sizes shall be indicated in the drawings.

7.26.39.5 Shop Drawings

The Contractor shall submit shop drawings of fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installations, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation.

7.26.39.6 Installation

All frames shall be erected plumb, square and true to line and level, with secure fastening to structures and anchors.

Door frames shall be installed by authorized representatives of the manufacturer, but before all plastering works are completed.

7.26.40 Aluminum Fitting

7.26.40.1 General

This clause covers all types of aluminum door, window, casements, and swing, sliding, pivoted, projected, fixed and combination doors and windows, including operation hardware.

7.26.40.2 Materials

Extruded aluminum shape and sheet shall conform to JIS H 4100 and H 4000 respectively or equivalent. Reinforcing strips, reinforcing struts anchors, etc. shall be of zinc plated steel plate conform G 310- SS41.

Small screws shall be of stainless steel conforming to JIS G 5121 SUS 304 or of high strength aluminum alloy conforming to JIS H 4040 or equivalent.

7.26.40.3 Shop Drawings

The Contractor shall submit shop drawings of fabricated items to the engineer for approval.

The shop drawings shall clearly show the details of fabrication, installation, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation.

7.26.40.4 Installation

All aluminum windows shall be installed by the manufacturer or his authorized representative and shall be set plumb, square, level and true to line.

Frames shall be set and securely anchored to the structure.

Aluminum surface in contact with other masonry materials shall be provided one heavy brush coat of bituminous paint. Upon completion of the work the contractor shall remove and clean all surplus materials from these areas.

7.26.41 Glass And Glazing

7.26.41.1 General

The contractor shall furnish and install all glass required in doors and windows in accordance with the drawings and any direction of the engineer.

The applicable standards for glass and glazing are listed below :

ASTM C1036-90	Specification for Flat Glass;
ASTM C1044-90	Specification of Heat-Treated Flat Glass Kind HS, Kind FT Coated and Uncoated Glass;
ANSI Z 97.1	Safety Performance Specifications and Methods of Tests for
CPSC 16 CFR	Transport Safety Glazing Materials Used in Building; Safety Standard for Architectural Glazing Materials.

7.26.41.2 Materials

- (1) Ordinary sheet glass shall conform to JIS R 3201 (Sheet Glass) or equivalent.
- (2) Polished plate glass shall conform to JIS R 3202 (Polished plate Glass) or equivalent.
- (3) Figured glass shall conform to JIS R 3203 (Figured Glass) or equivalent.

- (4) Wired glass shall meet conform to JIS R 3204 (Wired Glass) or equivalent.
- (5) Laminated glass shall conform to JIS R 3205 (Laminated Glass) or equivalent.
- (6) Tempered glass shall conform to JIS R 3026 (Tempered Glass) or equivalent.
- (7) Multiple glass shall conform to JIS R 3209 (Multiple Glass) or equivalent.
- (8) Putty shall conform to JIS A 5752 (Putty for Metal Sash Glazing) and JIS A 5753 (Putty for wooden Fittings).

Putty for steel fittings, the quality shall be class 1, for aluminum fittings, class 2 as specified in JIS A 5752.

- (9) The thickness of sheet glass and polished plate glass shall be 3.0mm for figured glass 4.0mm and for wired glass 6.8mm unless other wise specified in the drawings.

7.26.41.3 Workmanship

No glazing work shall be carried out during rain or when the frames or glass is wet. Frames shall be thoroughly cleaned before application of glazing compound.

All glass in windows and doors, except wooden doors, shall be set in full beds of glazing compound and pressed to a firm and even bearing without springing or forcing. Glass in windows shall be held firmly in place with snap type glazing beads and in doors with glazing channels or beads. Upon completion of construction work, all dirt, stains and mis-applied glazing compound shall be removed, and all glass shall be thoroughly cleaned on both faces.

7.26.41.4 Painting Work

7.26.41.5 General

Painting work shall be specified in clause “PAINTING WORK” in SECTION 1 “GENERAL PROVISIONS”, unless otherwise specified.

7.26.41.6 Interior Finish Work

7.26.41.7 General

This clause covers the performance of all works in connection with the following.

- 1) Vinyl asbestos tile
- 2) Acid proof vinyl tile
- 3) Vinyl base
- 4) Asbestos cementboard
- 5) Acoustic board

6)	Suspended ceiling
7)	Ceiling Access
8)	Insulation
9)	Nameplate for rooms
10)	Accordion partition
11)	Toilet Partition

Prior to starting work, samples of interior finish materials and shop drawings shall be submitted to the engineer for approval.

Types and sizes of nails, screws, bolts and quality of adhesives for fixing of interior finish shall correspond and match to characteristics of the interior finish materials and shall be submitted to the engineer for approval.

7.26.42 Fixing

Fixing shall not commence until after drying and cleaning of the base.

Fixing method of specified materials shall be in accordance with the manufacturer's specification and shall be submitted to the engineer for approval.

In performing fixing, adequate precautions shall be provided to avoid off set, gap and/or unevenness.

Suitable protection measures shall be provided on the interior finish until all finishing works are completed.

7.26.43 Vinyl Asbestos Tile for Floor Finish

Sizes of vinyl asbestos tile shall be 300mm x 300mm x 3mm thick conforming to JIS A5705 or equivalent.

- The tiles shall be resistant to alkali, grease or oils.
- The vinyl tiles shall be bonded with asphalt adhesives.

7.26.44 Acid-Proof Vinyl Tile

The tiles shall be of acid proof type vinyl tile. The shape and dimensions shall be the same as those of vinyl asbestos tile.

7.26.45 Vinyl Base

Vinyl base shall conform to the manufacturer's recommendation of vinyl asbestos tile for flooring unless otherwise indicated, the height of the base shall be 100mm.

7.26.46 Asbestos Cement Board

Materials shall conform to "Flexible Board" in JIS A 5403 (Asbestos Cement Sheets) or equivalent.

When necessary, chamfering shall be carried out so as to facilitate the making of joints and prevent their irregularity.

Hardware fixings shall be countersunk screws of stainless steel.

7.26.47 Acoustic Board for Ceiling

- (1) The material shall be of incombustible rock wool and perforated . The thickness of board shall be 12mm.

Acoustic boards shall be fixed on the base board with suitable adhesives or nails so as to facilitate the making of joints and prevent their irregularity.

- (2) Base Board for Ceiling

Base Board shall be plaster boards conforming to JIS A 6901 (Gypsum Board) Grade 2 or equivalent.

The thickness of board shall be 9mm.

7.26.48 Suspended Ceiling

The Contractor shall provide a light weight suspension system.

The system shall have the means to properly support the entire ceiling when it is in place.

7.26.49 Main Runner

Main runners for all suspension system, unless otherwise specified, shall be of cold rolled zinc bonded light channel steel (-38mm x 15mm x 1.6mm) conforming to JIS G 3350.

The channel runner shall be installed 90cm on centers and suspended by steel bars of 6mm dia. Hangers with level adjustable nuts at 90cm intervals.

The grid shall be leveled to within 1/500.

7.26.50 Cross Furring

Cross furring for ceiling shall be of cold rolled zinc bonded steel (M-23-mm x 23mm).

The M-furring shall be installed 30cm on centers and at right angles to the main runner by wire clips. All M-furring shall be straight in alignment and hold so as to enable level placement of plaster board on the suspension system.

7.26.51 Workmanship

The installation and workmanship shall be in strict accordance with the manufacturer's specifications and shall be made by skilled workmen.



7.26.52 Insulation

The contractor shall provide insulation boards under the roof slab.

The insulation boards shall be of 25mm thickness cemented excelsior boards conforming to JIS A 5404 or equivalent.

The insulation boards shall be fixed to forms of slab concrete by using nail.

7.26.53 Ceiling Access

Ceiling accesses shall be located at suitable places for maintenance of the lighting system and air conditioning ducts and shall be the size of 600mm x 600mm.

The materials of the frame for reinforcement of access board shall be made of the same materials as the ceiling, shall be of aluminum conforming to JIS G 4100.

7.26.54 Nameplate For Rooms

Name plates shall be provided on all doors of rooms facing out doors, corridors and other rooms. The size, materials and name on the plates shall be designated by the engineer.

7.26.55 Accordion Partition

Accordion partition shall be provided as indicated in the drawings.

Accordion partition shall be of vinyl chloride leather, runner, hinge plate (JIS G 3141 Spec. 1.2mm galvanized), wire rods (JIS G 3505 or equivalent) hanger rail (JIS H 4100-6063, T5 or equivalent) frames, (HIS H 4100-6063, T5 or equivalent) magnet, cushion rubbers and frame holder weight of partition 1m² shall be 7 Kg or less.

Panel shall be of plastic laminated board or steel and paper honeycomb.

Doors shall be of the same materials as panels and door frames shall be of Aluminum Alloy Extruded shapes.

7.26.56 Toilet Partitions in Case of common toilet:

Melamine coated plywood toilet partitions shall be furnished and installed at the locations indicated in the drawings and as described herein.

Toilet partitions shall supported by stainless standing supporters anchored into the floor and y head connection (galvanized square tubing).

Partitions shall be flush type, consisting of two sheets of waterproof plywood. The plywood shall be coated with melamine. All partitions and screen shall be erected plumb, level and in perfect alignment, with hardware fully equipped for proper operation.

7.26.57 Sodding And Planting

7.26.57.1 Sodding

7.26.57.2 General

The Contractor shall furnish all work including labor equipment, materials, construction, etc., in connection with sodding work.

7.26.57.3 Top Soil with Fertilizer

Stones, leaves, pieces of wood and all foreign matter shall be cleared away before placement of the top soil.

Top soil shall be approved by the engineer. The soil shall be hauled and placed when it is sufficiently dry for spreading.

Manure fertilizer shall be well rotted, unleached, and free from sawdust, shaving, refuse and / or harmful chemicals.

All manure delivered shall be free from any degree of fly manifestation. All manure fertilizer shall be spread and mixed with the top soil within 48 hours after arrival on the site. Fly breeding prevention shall be by the use of insecticides and / or larvacides as approved by the engineer.

Areas to be sodded shall be prepared by placing top soil in the areas to the required thickness.

The central part of such areas shall be made higher in comparison to the surroundings to ensure proper drainage.

7.26.57.4 Sod Planting

Sod planting shall be carried out where indicated in the drawings. Sod shall be planted in firm contact with the bed, and planting work shall be carried out by skilled workmen.

Density of sod planting shall be 70% or more of the area. After fixing the sheets of turf, sandy soil shall be spread at the rate of 0.01-0.02 m³ per square meter by using a sieve.

7.26.57.5 Leveling of Ground

Before planting the sod, the contractor shall remove all foreign matter, such as weeds, stones and pieces of wood and level the ground. The cost of the leveling of the ground shall be included in the price of the grass planting.

7.26.57.6 Watering

Watering equipment of the type which prevents damage to finished surfaces shall be used.

Should the sod become dry, it shall be watered so as to wet the transplanted sod through to the bottom and through to at least 5 cm of the sod bed as well.

Additional watering shall be made as directed by the engineer.

7.26.57.7 Protection

Protection of seeded beds against traffic, human or otherwise, shall be provided by erecting barricades immediately after work is completed and by placing warning signs, markers etc. as directed by the engineer.

7.26.57.8 Maintenance

Sodden areas shall be maintained (watering, cutting, etc.) by the contractor until taking over.

7.26.57.9 Clean Up

After the turning operation has been completed, the surface shall be cleared of all stones larger than 2cm in diameter and of all roots, brush, trash or other matter that may interfere with maintenance operations.

Any paved area over which hauling operation is conducted shall be kept clean and any top soil or other materials which may lie upon the paved surface shall be promptly removed.

7.26.58 Planting

7.26.58.1 General

The Contractor shall furnish all work including labor, equipment, materials, construction etc. in connection with planting work.

The Contractor shall submit colored pictures of all varieties of trees and flowers to be planted to the engineer for approval.

7.26.58.2 Planting Concept

The number of plantings and species of trees and shrubbery shall be as follows.

Trees	:	5 trees
Shrubbery	:	38m ²

Notes:	Tree	around 4.0m
	Shrubbery	less than 1.0m

Trees shall be planted so as to provide suitable shade.

The contractor shall survey the soil condition of the site for planting of the trees and shrubbery stated above and shall then carry in soil suitable for the said plants.

7.26.58.3 Workmanship

Before plants are carried to the site, the contractor shall prune one-fifth of the trees leaf areas but shall retain the natural form. Spray shall not cause wilting of the leaves. Planting details are

shown in the next sheets.

Ground Line to be the

Same as at the nursery
Tape (white)

Drawings

Surveyor's

Flagging

Fixing wire

Spread 120° Apart 50 x

100 x 900 Stake

Construct Earth Saucer
with

100mm high

Backfill with Fertilizer

7.26.58.4 SHRUB PLANTING DETAILS

7.26.59 Plumbing Equipment Work

7.26.59.1 General

This clause covers the performance of all water supply, sewage and sanitary equipment works to be executed according to the drawings and these specifications.

- (1) Water Supply Equipment
- (2) Sewage and Air Vent Equipment
- (3) Sanitary Equipment
- (4) Clarification Tank Equipment

The contractor shall submit shop drawings of the fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installations, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation and the contractor shall submit the result of tests at designated date specified herein-after.

The contractor shall provide the spare parts for three years normal operation, unless otherwise specified.

7.26.59.2 Equipment and Material

The equipment, materials and accessories as specified herein shall be furnished together with spare parts for three (3) years normal operation except as indicated otherwise.

7.26.59.3 Drinking Water Tank

- (1) Type of Drinking Water Tank

Drinking water tanks shall be of earthquake proof construction and consist of sandwich construction panel with facing materials comprising fiberglass reinforced polyester (F.R.P.) made from unsaturated polyester resin and glass fiber of which the core shall be formed plastic.

(2) Materials

The unsaturated polyester resin to be used for the facing material shall be waterproof and weather proof and harmless to human health.

The fiberglass shall be made from non alkali fiberglass as stipulated in JIS R 346~3417.

The foamed plastic materials to be used for the core shall be rigid and closed cell.

Any fillers and coloring agents shall be harmless to human health.

(3) Accessories

The drinking water tank shall be provided with the following accessories.

(a)	Water inlet pipe connections (F.R.P.)	1 set
(b)	Water outlet pipe connections (F.R.P)	1 set
(c)	Drainage pipe connections (F.R.P)	1 set
(d)	Connections for overflow hole and overflow nets (The insecticide nets shall be made of plastic and the connections shall be made of F.R.P)	1 set
(e)	Air passage and air vent with insecticide nets (The insecticide nets shall be made of plastic and the passage and vent shall be made of F.R.P)	1 set
(f)	Locking type manhole (Plastic Diameter : more than 500mm)	1 set
(g)	Reinforcing materials, support metals and stands for elevated water tank. (Rolled steel having properties in accordance with JIS G3101 and with dimensions and shapes in accordance with JIS G3192)	1 set
(h)	Steel ladder	1 set
(i)	Electrode mount	

(j) Breakwater cover

1 set

(4) Shapes, Dimensions and Performance

The shapes and dimensions of the elevated water tank shall be in accordance with the manufacturer's specifications, and the performance shall be as specified in "List of Equipment" in the Design Drawing.

7.26.59.4 Pressure Pump Unit

(1) Type

Pressure pump unit shall be factory built and factory tested product.

The unit is consisting of two pumps, small pressure tank, control panel, necessary pipes, cable and pressure gauge these components are arranged on the common steel frame.

(2) System Operations

- (a) In initial operation, one pump starts by push button provided on control panel and starts to supply water in the pressure tank. The pump stops when the pressure rise of the pressure tank.
- (b) When by consumed water in the pressure tank the pressure in the pressure tank fall the other pump starts to run and supply water to pressure tank.
- (c) All the signal of pumps START-STOP are controlled by a pressure switch provided on pressure tank.

(d) Specifications

Quantity	1 set
Discharge bore	40 mm
Tank Capacity	30 liters
Pump Quantity	2 set/ unit
Type	End section centrifugal motor closed coupled type End section centrifugal motor closed coupled type Pump Speed 3,000rpm.
Materials Casing	Cast Iron
Shaft	Stainless Steel
Impeller	Bronze
Motor Type	Drip-proof, squirrel cageraptor
Voltage	400V
Frequency	50Hz.
Insulation Class	E

(4) Accessories

Check Valve JIS 10kg/cm² 50-2 pieces Gate Valve JS 10kg /cm² 50 – 4 pieces

7.26.59.5 Water Supply Pump

(1) Type

Water supply pump shall be submergible pump, using of submerged motor and multistage centrifugal pump.

(2) Specifications

Liquid Fresh water or equivalent Temperature 0-40 °C

Impeller Multi stage centrifugal Shaft Seal Oil Seal

Bearing Sleeve bearing Cashing Cast Iron.

Impeller Bronze Shaft Stainless Steel

Flange Standard 10kg/ cm² thin type Motor Submerged canned type

Motor Insulation Class E

(3) Accessories

10 meters water proof cable

7.26.59.6 Sterilizing Equipment

(1) Type

The sterilizing equipment shall be chlorine sterilizing type, including of sterilizing chemical tank chemical feed pump, flow sensor, necessary pipes and cables.

(2) Operation

The equipment shall be designed to inject the chemical in proportion to the flow rate of drinking water, using a diaphragm pump.

(3) Specification

(a) Sterilizing Chemical Tank

Material : Polyethylene
Volume : 50 liter

(b) Chemical Feed Pump

Type Discharge variable diaphragm type

Output : 0.025KW
Phase : 1ø

Frequency	:	50 Hz
Voltage	:	AC 220V

(c) Flow Sensor

Flow sensor shall distribute electric pulse in proportion to the flow rate.

(4) Accessories

- (a) Chemical feed pipe; high pressure blade hose 6mmø ; 3 m length
- (b) Chemical suction pipe; vinyl pipe 5 mmø ;1 m length
- (c) Pump base ; 1 set (including anchor bolts)
- (d) Injection valve ; made of PVC ; 1 set
- (e) Cable ; CVV 2 mm² – 2C ; 3 m
- (d) Sterilizing Chemical ; 1 set

7.26.59.7 Water Filter

(1) Type

Up-light casing, cartridge filtering element type

(2) Materials and Specification

Casing –stainless steel

Normal use maximum pressure – stainless steel

Filtering element – exchangeable plastic cartridge (reusable by water washing type)

(3) Accessories

Spare filtering element	-	1 set
Drain Cock	-	1 set
Air Cock	-	1 set
Hole- in-anchor	-	1 set

7.26.60 Sanitary Equipment and Accessories

7.26.60.1 General

- (1) All sanitary wares shall be of European standard high quality or equivalent to JIS A 5207.
- (2) All fittings for sanitary wares shall be in accordance with European standard high quality JIS A 5514 or equivalent
- (3) All accessories and visible sanitary wares such as faucets, flush valves and flushing pipes shall be nickel chromium plated.

7.26.60.2 Water Closet (Western/European Style)

- All Sanitary Fittings & Fixtures should be European Made as well as approved

sample and design.

7.26.60.3 Wash Basing (For Lavatory)

- (1) Wash Basin
V.C., 6.5 & wall hanging type
- (2) Accessories
 - (a) Pillar cock (13mm)
 - (b) Angle type stop cock (13mm)
 - (c) Washer basin trap
 - (d) Back hanger
 - (e) Liquid soap holder (Vertical type 350 cc)

7.26.60.4 Wash Basin (For Battery Room)

- (1) Wash Basin V.C., 9.5 &
- (2) Accessories
 - (a) Pillar cock (13mm)
 - (b) Eye bath
(Vertical flexible type, 13mm)
 - (c) Angle type stop cock (13mm) with water supply pipe
 - (d) Wash basing trap
 - (e) Back hanger
 - (f) Liquid soap holder (push button type, 360cc)

7.26.60.5 Service Sink

- (1) V.C. with Back
 - (2) Accessories
 - (a) Sink faucet (20mm with feed seat) : (b) Trap (S type) :
 - (c) Trap connection fixtures :
 - (d) Chain and stopper : (e) Back hanger : (f) Rim cover
- :

7.26.60.6 Mirror

The mirror shall be frame-less and moisture proof, and the glass for mirror shall be 5mm thick and 360x455 mm in size, and in accordance with JISD 3202 (Float, Polished Plate Glass) or equivalent BDS standard.

7.26.60.7 Water Cock and Similar Items

The main structures constituting the septic tank shall be made of FRP (fiberglass reinforced plastic) having appropriate shape, dimensions and capacity. The structures shall have sufficient strength against soil pressure, water pressure, load etc. and shall be of a construction permitting easy inspection and cleaning. The functional requirements shall be as follows.

(1) Treatment Capacity

- (a) Accommodation treatment for : 5 persons
- (b) Estimated daily average volume of waste : 1 m³ / day
- (c) BOD concentration in discharge water : 90 ppm.

(2) Tank Equipment

The septic tank shall consist of blower unit, pretreatment tank and main tank and the equipment required for the tank shall be of the following specifications.

Blower Motor: 0.04 m³ / min, 0.2 KW, three Phase, 415V, 50 Hz x 1 set

Accessories : Distribution board and cable, air piping and required pertinent.

(3) Accessories

Sterilization Chemical : 1 set Sanitary

appliances shall conform to the following standards:

BDS 1162: 1987	Specification for Ceramic Wash Basins and Pedestals;
BDS 1163 : 1987	Specification for Vitreous Sanitary Appliances, Part-1, General Requirements;
	Part-2, Specific Requirements for Water Closets;
	Part-3, Specification Requirements for Urinal (Bowltype);
	Part-4, Specific Requirements for Foot Rest;
	Part-5, Specific Requirements for Integrated SquattingPans.
ASHRA E90A-80	Energy Conservation in New Building Design;
ASHRA E 90B-75	Energy Conservation in New Building Design;
AWWA C700-77	Cold Water Meter Displacement Type; AWWA
C701-78	Cold Water Meter Turbine Type Class-I; AWWA
C702-78	Cold Water Meter Turbine Type Class-II;
AWWA C702-78	Cold Water Meter Compound Type,

BS 1125: 1987 (Including Dual	Specification for WC Flushing Cisterns
BS 1244	Flash Cisterns and Flush Pipes);
BS 1254:1981	Metal Sink for Domestic Purposes;
BS 1329:1974	Specification for C Seats (Plastics);
BS 1876: 1992 (1977)	Specification for Metal Hand Rinse Basins;
Urinals	Specification for Automatic Flushing Cistern for

7.26.61 TREATMENT PROCESS OF SEPTIC TANK

7.26.61.1 Piping Materials and Pipe Fittings

7.26.61.2 Pipe (1) Water Supply Pipes

The water supply pipe shall be the steel pipe lined with rigid PVC in accordance with JWWA-K66.

(2) Drainage and Air Vent Pipes

The drainage and air vent pipes shall be the galvanized steel pipe in accordance with JIS G 3442, tar-epoxy coating steel pipe in accordance with JIS G 3443 and HASS-210, and/ or the centrifugal reinforced concrete pipe as specified in JIS A 5303.

7.26.61.3 Pipe Joint

(1) Water Supply Pipe Joints

The water supply pipe joints shall comprise screwed type and flange type. Screwed type pipe joints shall be malleable cast iron pipe joints coated with plastic in accordance with JIS B 2301. The flange type pipe joints shall be made by welding the flange to the end surface of the steel made joints as stipulated in JIS B 2211 or JIS B 2212, and further by lining the internal surface with rigid PVC of the same specification as that used for lining of the steel pipe.

(2) Drainage and Air Vent Pipe Joints

The drainage and air vent pipe joints shall be malleable cast iron pipe joint in accordance with JIS B 2301, screwed type drainage pipe joint in accordance with JIS B 23.3 and rigid PVC pipe joint in accordance with JIS K 6739.

7.26.61.4 Gate Valves

The gate valve shall be the 10 kg. Cm² bronze screwed or flanged type gate valve as stipulated in JIS B 2023, and B 2044.

7.26.61.5 Check Valves

The check valve shall be the 10 kg /cm² bronze screwed or flanged swing check valve as stipulated.

7.26.61.6 Flexible Joints

The flexible joint shall be of a bellows type and shall have sufficient flexibility and resistance against pressure. The bellows and protective steel band shall be made of cold rolled stainless steel plate / sheet (SUS – 304) as stipulated in JIS G4305.

The length of one flexible section shall be 400mm.

7.26.61.7 Strainers

The strainer shall be of a Y type. The case the nominal diameter is 50mm or less, the strainer shall be of a screwed type made of bronze, but in case the diameter is 65mm or over, the strainer shall be of a flanged type made of cast iron.

The clean out plug shall be made of brass, and the strainer element shall be made of stainless steel, one spare strainer element shall be furnished.

7.26.61.8 Drainage Pipe Fitting

(1) General

- (a) The water sealing depth of trap shall be 50mm or more, and the effective area of the drainage hole for strainer shall not be less than the sectional area of the drainage pipe.
- (b) The nickel chromium plated section of the drainage pipe fittings shall be equivalent to or higher than Class 1 or Grade 2 in JIS H 8617 (Electroplated coating of Nickel and Chromium).

(2) Floor Drain Trap

The floor drain trap shall be made of cast iron and the strainer shall be nickel chromium plated brass. The floor drain trap for asphalt waterproofed floor shall be of a waterproofing type, but that for other floors shall be of an ordinary type.

(3) Floor Clean out

The floor clean out shall be of a screwed type made of brass having a nickel chromium plating finish. The floor clean out for asphalt waterproofed floor shall be of a waterproofing type, but that for other types of floors shall be of an ordinary type.

(4) Under floor Clean out

The under floor clean out shall be of a screwed type made of brass.

(5) Drainage Pipe Fittings

The drainage pipe fittings shall be made of brass having a nickel chromium plating finish and the chain and stopper shall be made of stainless steel.

7.26.61.9 Pipe Washers

The pipe washer shall be made of nickel chromium coated brass or stainless steel.

7.26.61.10 Pipe Sleeves

The pipe sleeve shall be made of steel pipe or steel plate with a thickness of 0.4mm or over (0.7mm or over in case the nominal diameter exceeds 200mm). However, the non-water proofed floor pipe sleeve to be used indoors shall be made of laminated cardboard.

7.26.61.11 Pipe Support Fittings

- (a) The pipe support fittings shall be resistant to contraction and expansion, rolling etc. of pipe and be of a construction having sufficient bearing strength against load of pipe when liquid is contained inside. The materials to be used shall be in accordance with JIS G 3101 (Roll Steel for General Structure).

All steel fittings shall be finished by galvanizing.

- (b) The inserts shall have sufficient strength for supporting the pipe and shall have a construction having suitable for connecting hangers etc. All inserts shall be made of cast iron, press formed malleable cast iron or steel plate.

7.26.61.12 Cementing /Bonding Materials

(1) Thread Sealing Materials

- (a) The thread sealing tapes shall be in accordance with JIS K6885 (unsintered polytetrafluoroethylene tapes for thread sealing (raw tapes) , and shall neither be hazardous to human health nor cause adverse effects upon drinking water.
- (b) The paste sealing agent shall not be affected by the liquid in pipe and shall consist of contents applicable to the purpose of use. In case the agent is used for sealing of piping for drinking water, it shall not be hazardous to health nor cause any adverse effect upon drinking water.

(2) Packing(s)

The packing shall be in accordance with JIS K6353 (Rubber Goods for Water Works Service) JIS R3453 (Compressed Asbestos Sheets) etc. and have sufficient durability applicable to the respective quality of water, water pressure, temperature etc.

(3) Caulking Lead

The caulking lead shall, in principle be the 5th Class of those stipulated in JIS H2110 (Pig Lead).

(4) Caulking Hemp

The caulking hemp shall in principle be the jute of #130 single thread

which, tied in abundle has a diameter or about 25mm.

7.26.61.13 Basin and Basin Cover

(1) General

- (a) The materials for iron castings shall be equivalent to of higher than Grade 3 as stipulated in JIS G5501 (Gray Iron Castings)
- (b) The iron castings shall be baked with refined tars in accordance with JIS K 2473 (Processed Tars) to which more than 2% of linseed oil or drying oil is mixed, or shall be cold painted with refined bituminous materials to which synthetic resin finishes added.

(2) Invert Basin

- (a) The invert basing shall be of a concrete construction and all visible portions shall be finished by mortar, the basin shall be furnished with a cover and an invert applicable to the piper diameter shall be provided on the bottom of the basin.
- (b) The cover shall be make of cast iron with chain, and shall be of an door proof typeable to withstand the weight of 2,500kg.

(3) Drainage Basin

- (a) The drainage basin shall be a concrete construction and all visible portions shall befinished by mortar coating. Moreover, the basin shall be furnished with a cover.
- (b) The cover shall be made of cast iron with chain and shall be of an door proof typeable to withstand the weight of 2,500kg.

7.26.62Execution

7.26.62.1 Foundation Works

- (1) The foundation shall be of reinforced concrete construction able to withstand the weight ofequipment and external forces and having sufficient bearing surface for installation of equipment. The foundation shall be built on the floor or ground having sufficient bearing capacity.
- (2) Cement to be used shall be the ordinary Portland cement in accordance with JIS R5210 (Portland Cement).
- (3) Regarding the sizes of aggregate, the size of gravel shall be 25mm or less that of crushedstone shall be 20mm or less and that of sand shall be 2.5mm or less.

7.26.62.2 Erection Works

7.26.62.3 Drinking Water Tank

- (1) The drinking water tank shall be firmly fixed with anchor bolts shaving

sufficient strength so that the tank will not slide laterally nor move in any way due to horizontal seismic force.

- (2) The drinking water tank shall be installed on a horizontal plane on the foundation having a steel made base and the foundation shall have an even bearing surface against the load. The tank and the steel base shall be fixed firmly with anchor bolts.
- (3) After installation, the tank shall be cleaned and washed with water. Then, the tank shall be sterilized by using solution of hypochlorous acid, etc.
- (4) The piping related to the tank shall be so supported that weight of the pipes not be applied to the tank.

Flexible joints shall be provided for all respective connecting pipes to the water tank except for the drain pipe and air vent pipe.

7.26.62.4 Wall Hanging Type Electric Water Heater

The wall hanging type electric water heater shall be set firmly on the wall by using expansion joints.

7.26.62.5 Sanitary Ware, Accessories and Fittings

- (1) General
 - (a) In case wall hanging fittings are fixed on a concrete wall or brick wall, expansion bolts shall, in principle be used.
 - (b) In case a metal panel or lightweight steel framed board wall is set, steel plate and worked angle materials or hard wood patch shall be fixed to the sanitary ware in advance.
 - (c) In case a part of the sanitary ware is embedded in concrete, the portion of the sanitary ware that comes into contact with concrete or mortar shall be covered with asphalt having a thickness of 3mm or over. However, the bottom contact surface of sanitary ware, shall be filled with sand.
- (2) Water Closet (Western/European Style)
 - (a) The upper end of the stool shall be set horizontally in place after deciding the precise setting positions.
 - (b) Prior to connecting the stool to the drain lead pipe the connecting end of the lead pipe shall be flared up to the diameter of the flange, and after inserting the non drink sealing materials between the external surface of the flange and connecting end the stool shall be connected to the drain lead pipe by nuts fastened from above by flange fittings and bolts. The plate thickness of the external end of the flared lead pipe shall not be less than 2mm.

Moreover, the end of the flange for the lead pipe to be connected to the stool shall be supported sufficiently with hangers etc. so that no load of drain pipe, etc, will act directly on the stool.

(3) Wash Basin

- (a) The bracket or back hanger/s shall be firmly set in place, and the wash basins shall be fixed carefully so that the upper surface of the basins will be kept horizontal without exhibiting looseness. In order to eliminate leakage of water, heat resistant non drying sealing materials shall be filled around drain holes of the basins and around openings between the drain pipe fittings.
- (b) The setting height of the basins shall be 800mm (approximate) from the floor surface to the upper front end of the basins.

(4) Service Sink

The trap shall be set in place without any misalignment, and the connection of the sink to the drain pipe shall be carried out in accordance with the procedures for connection of stool in (2). Setting of back hanger(s) and connection between drain holes of the SINK and drain pipe fittings shall be carried out in accordance with the procedures for the above wash basins in (4).

(5) Water Cock

The water cock shall be fixed firmly after precise centering by fully taking into account the convenience of use and harmony with the surrounding facilities.

A sufficient space for the spout shall be provided between the end of the spout of watercock and the flood level rim of the drain receptacle.

(6) Mirror

The setting height of the upper end of the mirror shall 1,800 mm from the floor surface.

7.26.62.6 Septic Tank

Reinforced concrete foundation shall be provided and the tank shall be firmly fixed to the foundation so as to withstand upward water pressure.

7.26.63 Piping

7.26.63.1 Water Supply and Water Hydrant Piping

(1) General

- (a) Prior to execution of piping work, detailed study shall be made on the relationship between other piping and equipment, and all positions for pipe laying shall be decided by taking into account the precise slope of the respective piping.

In the case where piping is laid inside a building, setting of the pipe support fittings and embedding of pipe sleeves shall be carried out without any delay and in accordance with progress of the work.

- (b) The flange joints shall be inserted for all main piping at appropriate intervals in order to ensure easy removal of such piping.
- (c) In the case where any piping is branched from the main piping, T-joints shall be used.
- (d) As air release valve shall be provided at the dead air space portion in piping, and a mud discharge valve shall be provided at the portion where mud is collected. The size of the mud discharge valve shall be the diameter of the related pipe, provided that the size of the valve shall be 25mm in case the nominal diameter of the pipe exceeds 25mm.
- (e) In case any anti-sweat covering is not provided for piping, pipe washers shall be fixed to all portions of piping that penetrate through ceiling, floors, walls etc and is visible from the outside.
- (f) Any openings between the piping that penetrates through fire service areas etc. shall be filled with rock-wool heat insulation or other non-combustible materials.
- (g) In case where a pipe sleeve is used at a place requiring water tightness, lead caulking shall be provided in the opening between the sleeve and pipe.
- (h) In the case where any steel pipe and similar materials are laid under the ground, such pipe shall be protected against corrosion by either a double coating of coat tar or a double winding of corrosion proof vinyl tapes (JIS Z 1901 "Protective Polyvinyl Chloride Tapes).
- (i) Any repair of steel pipe, cast iron pipe and lead pipe with caulking shall be prohibited.
- (j) After completion of piping work, the inside of the piping shall be cleaned by water pressure on the occasion of hydrostatic test of the piping. In the case of piping for drinking water. The piping shall be sterilized until free residual chlorine of 1.2ppm or over has been detected at the end of the piping.

(2) Gradient

In the case of horizontally running pipe, the up feed pipe shall have an upward slope and the down feed pipe shall have a downward slope. In principle, the gradient shall be 1/250.

(3) Support Pitch

- (a) The support pitch of the horizontally running pipes shall, in principle, be in accordance with the values in the following table and, wherever

necessary , all bent sections and branching sections shall be supported. In the case where steelpipes or similar pipes are supported with hangers, a steady rest shall be providedfor each horizontally running pipe in order to avoid looseness of the pipe due to movement at the time of earthquake.

- (b) A steady rest shall be provided for indoor vertical pipe at least at one spot on everyfloor.

Table-12.1 : Maximum Support Pitch of Water Supply Pipe

Nominal pipe Diameter	20 or less	25 – 40	50 – 80	100 – 150	200 or more
Support pitch	1.8	2.0	3.0	4.0	4.0

7.26.63.2 Drainage and Air Vent Pipe

- (1) General
- (a) All horizontally branched drainage pipes, etc. shall be combined nearlyhorizontally at an acute angel of less than 45⁰.
- (b) In case bent lead pipe is used, the pipe shall be carefully fabricated so as not toimpair its roundness, and no branch drainage pipe shall be taken for protection.
- (c) No waste water shall be discharged directly form the form the followingequipment.
- Air conditioners
 - Drinking water tank
 - Pumps
- (d) Indirect drainage pipe shall be opened while maintaining a space of over twice the diameter of the pipe from the drain receptacle and flood level rim. In case an obstacle is foreseen in providing the above opening, appropriate measures shallbe taken for protection.
- (e) The lowest portion of the vertical drainage pipe shall be fixed with a support standwhere necessary.
- (f) Any air vent pipe shall be run out vertically or at an angle of less than 45⁰ from the horizontally branched drainage pipe and in no case shall the pipe be run outhorizontally.
- (g) In the case where air vent pipes on floors are connected to vertical air vent pipes,the said pipes shall be connected at the place over 150mm from the flood level rim of the related equipment. Vertical air vent valves shall be connected to the stack vents in accordance with the above procedures.

- (h) In case a hump pipe is buried, a pit shall be excavated from the lower ad of the pipe to depth of about 100mm in case the nominal diameter of the pipe is 300mm. After unscrewed crushed stone, unscreened gravel or pike sand has been laid and compacted, the pipe shall be laid. However, the portions where joints are provided shall be excavated further if necessary.

Initial back filling of pipe shall be carried out up to the center line of the pipe to ensure immovability, and after sufficient compaction, the pipe shall finally be buried.

Provisions other than those described in this paragraph shall be in accordance with the general provisions in 12.3.4.1.

(2) Gradient

The gradient of horizontally running drainage pipes said inside a building shall be 1/

100. All air vent pipes shall have an upward slope facing the vertical pipes and shall be free from reverse slope and unevenness.

(3) Support Pitch

(a) The support pitch of steel pipes shall be in accordance with the applicable provisions in Table 12.1.

(b) Horizontally running cast iron pipes shall be supported at a pitch of less than 1.6m, and the deformed fittings to be connected shall be supported at a pitch of less than 0.6m, respectively.

(1) Connection of Pipes

(a) All pipes shall be carefully cut at a right angle against the axial center of the pipe so as to avoid any deformation of the sections, and the cut end shall be finished smoothly.

(b) All pipes shall be connected after removing any chips, dust and other foreign matter and after confirming that all such foreign matter has been completely removed from inside the pipes.

(c) In case piping work is temporarily suspended, all pipes shall be sufficiently protected to avoid entry of any foreign matter.

(2) Water Supply Piping

(a) No water supply piping shall in principle, be connected according to an insertion system unless specified otherwise.

(b) Epoxy resin or synthetic rubber rust inhibitors shall be sufficiently coated over the end face of threaded portions and the bottom of threaded portions of joints. All rust inhibitors to be applied for any drinking water piping shall be applied for any drinking water piping shall be harmless to human health and shall cause no harmful effect to the quality of drinking water.

(3) Drainage and Air Vent Piping

- (a) Prior to connecting the galvanized steel pipes, the pipes shall be correctly threaded so that a slight clearance is provided between the end face of pipes and the recess of joints in order to obtain the tapered threaded pipe portion. Then, the steel pipes shall be screwed tightly into the joints.
- (b) All case iron pipes shall be connected by using rubber rings. In this case, the pipes shall be inserted into the rubber rings until the end of spigot comes into contact with the bottom of socket. Then, the rubber rings that have been inserted into a position near the end of spigot in advance shall be inserted into the pipes carefully so that no twisting will occur in the opening between the socket and spigot. Then, the rubber rings shall be set in close contact with the pipes while uniformly fastening the tap bolts and nuts using a junk ring.
- (c) All rigid PVC pipe shall be carefully connected by a cold working method so that no step will occur between the connected pipes. The flow of water in the piping shall be smooth and uninterrupted.
- (d) All centrifugal reinforced concrete pipes shall be connected by using collars.

After both ends of the pipes have achieved tight contact with each other at the central part of the collar and carefully set in place to ensure proper alignment in the surrounding opening, stiff consistency mortar shall be placed into the opening. In this case, all cement and water inside the pipes shall be thoroughly removed. In case one end of a pipe is made into a socket form after connecting a collar to the end with mortar, mortar shall be placed about 10mm away from the pipe end.

7.26.64 Antisweat Covering

7.26.64.1 Materials

The anti sweat covering materials, exterior and auxiliary materials shall be as specified in Table below.

Table - 12.2.1 : Antisweat Covering Materials, Exterior and Auxiliary Materials

(1/2) Classification of materials : Specifications

Heat insulation materials

Glass wool heat materials : The glass wool heat insulation tubes shall be in accordance with

JIS A9505 (Glass wool heat insulation materials) or equivalent

Exterior Materials

Galvanized Sheets : The galvanized sheets shall be in accordance with grade 2 in JIS G3302

(Galvanized Sheets.) The standard thickness of original sheet shall be 0.3mm when the sheet is used for insulating pipes, valves, etc. with an outside diameter of 250mm or less, but in other cases, the thickness shall be 0.4mm.

Cotton Cloth : The weight of cotton cloth shall be 115g or more per 1m^2 In case, the cloth is used for pipe, etc. it shall be cut into appropriate widths of a tape form.

Glass Cloth : The glass cloth shall be non-alkali plain glass cloth obtained by processing EP211C into a non-fraying type as stipulated in JIS R3414 (Glass Cloth).

PVC Type (Vinyl Tape) : The PVC tape shall be non-tacky tape of medium gloss with a thickness of 1.2mm in accordance with JIS Z1901 (Protective Polyvinyl Chloride Tapes).

Waterproofing Temp cloth (Linen) : The waterproofing linen shall be Hessian cloth No. 7 as stipulated in JIS L 2405, over one side of which blown asphalt, as stipulated in JIS K2207 (Petroleum Asphalt), has been coated. The linen shall be cut into a tape form of appropriate width in case it is used for waterproofing of pipes etc.

Table -12.2.2 : Antisweat Covering Materials, Exterior and Auxiliary Materials

(2/2) Classification of materials : Specifications

Auxiliary Materials

Molding base paper : The base paper shall be molding base paper of 370g or more per m^2 .

Asphalt roofing : The asphalt roofing shall be the one manufactured in accordance with JIS A6006 (Asphalt Roofing Felts) (Fiber Base) (Self-Finished Bitumen Felts), and more than 17kg per roll (21m^2).

Iron Wire : The iron wire shall be the one as stipulated in JIS G3532 (Barbed Wires) which has been galvanized.



Steel Frame : In principle, the steel frame shall be the one made of steel sheet with a standard thickness of the original sheet of 0.4mm or more as stipulated in JIS G 3302 (Galvanized Sheets)

Adhesive PVC Tape : The adhesive PVC tape shall be in accordance with JIS Z1525 (Pressure Sensitive Adhesive Polyvinyl Chloride Tapes) with a thickness of 0.2mm.

Band and toothed lock washer : The band toothed lock washer shall have a thickness of 1.2mm or more, and shall be made from the materials in accordance with JIS G4305 (Cold Rolled Stainless Steel Strips), or JIS H3201 (Brass Plates). However, the ones made from brass shall be finished by nickel chromium Plating.

The width of band shall be 20mm.

Adhesive : In principle, acrylic emulsion adhesive shall be used for adhesion of glass cloth, glass filament mat and aluminum glands cloth. Vinyl acetate adhesive shall be used for adhesion of formed polystyrene heat insulation materials, and the chloroprene rubber adhesive for adhesion of rivets.

7.26.65 Execution
7.26.65.1 General

- (a) The thickness of insulation shall be that of the main insulation material and shall not include the thickness of exterior materials and auxiliary materials.
- (b) The clearance between mutual insulation materials shall be as small as possible, and in no case shall joints for overlapping sections be provided on the same line.
- (c) Band and tube shaped covering shall be tightly bound with galvanized wire. Bands shall be bound at a 50mm pitch and tubes shall have two windings at least three places per tube. All overlapping portions and joints of tubes shall be joined together by using adhesive tapes.
- (d) In principle, the width of tape winding shall be 15mm or more, and the width of other overlapping portions shall be 35mm or more. In the case of waterproof linen wrapping, galvanized wire shall be wound twice over the wrapping at an interval of 2m, then asphalt primer shall be coated twice

of the windings.

- (e) Tapes shall be wound starting from the lower part and then proceed to the upper part of piping. Should there be any possibility of deviation in case of polyvinyl chloridetape, etc., such deviation shall be eliminated by using adhesive tapes etc.
- (f) The lagging plate over the insulation of the pipe shall be carried out in a bed over form, and that of the vent section shall be carried out into a fan form.
- (g) Shake-proof washers shall be attached to the ends of heat insulation sections for indoor piping, and bands shall be attached to branch and bent sections of the piping.
- (h) The ends of heat insulation sections shall be protected as required depending upon the types and purposes of heat insulation materials to be used.

(2) Materials and Sequence of Works according to the types of heat insulation

The materials and the sequence of work according to the types of heat insulation are as indicated in Table 12.3.

Table - 12.3

Type of Covering Work	Materials and Sequence of work	Remarks
	(I) Glass wool heat insulation materials	
A piping	1. Heat Insulation tube 2. Galvanized Wire 3. Rough Paper 4. Cotton Cloth	Outdoor exposed
B	1. Heat Insulation Tube 2. Galvanized Wire 3. PVC Tape	Inside Ceiling and pipe Shaft

(3) Thickness of the Heat Insulation (Coverings)

The thickness of the insulation shall be as indication in Table 12.4.

Table - 12.4 : Thickness of Insulation

										(Unit: mm)	
Nominal dia. Type	10	20	25	32		40	50	65	80	100	Remarks
I water supply drainage piping	20	20	20	20	20	2	20	20	25		Glass

- (3) Heat Insulation (Coverings) for water supply pipes (including joints and valves)
- (a) The materials and sequence of works according to the types of work shall be in accordance with Table 12.3.
 - (b) The thickness of insulation shall be in accordance with Table -12.4.

Table 12.5

Place of application	Materials and sequence of work	Thickness of Insulation
Indoor exposed piping	a	I
Piping inside ceiling and pipe Shaft	a	I

- (4) Anti sweat Covering
- (a) The materials and the sequence of work according to the types of work shall be in accordance with Table 12.3.
 - (b) The thickness of the insulation (Covering) shall be in accordance with Table 12.4.

Table - 12.6

Place of application	Materials and sequence of work	Thickness of insulation
Indoor exposed piping	a	I
Piping inside ceiling and pipe Shaft	b	I

- (5) No insulation shall be provided for the following pipes, valves and flanges.
- (a) Devices and piping (including drainage pipe on the floor below sink) which are considered accessories for sanitary wares.
 - (b) Piping for water supply and drainage underground or inside concrete.
 - (c) Water supply piping laid indoors (excluding the piping to be laid inside ceilings and highly humid areas).

- (d) Hot water supply piping valves and flanges .
- (e) Out door exposed drainage piping.
- (f) Air vent piping (excluding the portion of 100mm from the branch point of drainage pipe).
- (g) Overflow pipes and drain pipes for various tanks and similar equipment.

7.26.65.2 Painting Work

(1) General

All respective equipment and materials, except the following, shall be painted. Equipment and materials, except those requiring corrosion proof painting to be buried.

(2) Painting

The types of paints and frequency of painting of portions to be painted shall, in principle, be as specified in Table 12.7.

7.26.65.3 Civil Works

Items other than those specified in the following shall be in accordance with the specification/s for “Reinforced Concrete Works”

- (3) The pit for piping under the ground shall be so excavated that the required gradient can be kept precisely and the piping can be connected easily.
- (4) The foundation and pit for tanks, etc. shall be excavated sufficiently taking into account the space for assembly and removal of forms.

Table - 12.7.1 : Types of Paints and Frequency of Painting of Respective Portions (1/2)

Portions to be painted			Frequency of painting			emarks
Equipme nt and members	Conditions		Primer Painting	Inter Coating	Face Coating	
Supports, racks and similar fittings (Other than galvaniz ed materials	Exposed	Ready mixed paint or aluminu m paint	2	1	1	The primer coating shall be anticorrosive pain

	Canceled	Anticorrosive	1	-	1	
Heatinsulate exterior (cotton and cloth)	Exposed	Readymixed paint	1	1	1	The primer coating shall be sealer coating
	Canceled	Sealer coat	1	-	1	
Hearinsulated exterior (Glass cloth)	Canceled	Synthetic resin emulsion paint	1	1	1	After the glass cloth has been precisely bonded and made sufficiently dry, synthetic resin emulsion paint as stipulated in JIS K 5663 shall be used.
	Exposed	Polyvinyl chloride resin enamel	1	1	1	After the glass cloth has been precisely bonded and made sufficiently dry, emulsion putty shall be applied twice and after surface finish with paper file, resin enamel shall be applied.

Table - 12.7.2 :Types of Paints and Frequency of Painting of Respective Portions (2/2)

Portions to be painted			Frequency of painting			Remarks
	Types of paints					
Equipment and members	Conditions		Primer painting	Inter canting	Face Coating	
Heat-insulate exterior(Galvanized iron plate/board)	Exposed	Readymixed paint	1	1	1	The prim er coating shall be anti-corrosive paint
				2nd		
				Coating		
Lined steel pipes and coated steel pipes including joints	Exposed	Readymixed	2	1	1	The primer coating shall anti-corrosive paint.
	Canceled	Anticorrosive paint	1	-	1	Excluding resin-coating joints.

7.26.66 Test

7.26.66.1 Hot Water Storage Tank

The hydrostatic test shall be carried out for the instantaneous type electric water heater. The hydrostatic test pressure shall be 17.5 kg/cm² (shortest)

7.26.66.2 Water Supply Pipes

The hydrostatic test of water supply pipes shall be carried out prior to coating work during piping work or prior to shielding and backfilling or after completion of piping. The minimum pressure retention time shall be 60 minutes.

The test pressure of piping below elevated water tanks shall be twice the pressure equivalent to the static head.

7.26.66.3 Drainage Pipes

The water filling test of the drainage pipes shall be carried out prior to coating work during piping work or prior shielding and back filling or after completion of piping. The water passage

test of sanitary drain pipes shall be carried out after sanitary wares etc. have been attached. The minimum water retention time in case of water filling test shall be 30 minutes or more and that in case of the water passage test shall be 15 minutes or more.

7.26.66.4 Test of Raw Water

After the completion of the water receiving tank and water suction pump, the contractor shall test the quantity and quality of the raw water collected from the well.

The test shall be in accordance with article 4 (Water Quality Standard) of water service law of Japan.

The test items shall be as follows :

- Cyanide
- Mercury
- Organism Mercury
- Organism Phosphorus
- Lead
- Chromium
- Arsenic
- Fluorine
- Cadmium
- Nitrogen of nitric acid
- Colon bacilli's

The results of the tests shall be submitted to the Engineer.

7.26.66.5 Test of Treated Water

After the completion of drinking water system, the contractor shall test the quality of the treated water collected from the cocks. The test shall be in accordance with article 4 (Water Quality Standard) of water Service Law of Japan.

The test items shall be as follows :

- Turgidity
- Chromatizitat
- Stench
- Taste
- Potential of hydrogen
- Organic matter
- Nitrogen of ammonia
- Chlorine Iron
- Evaporation
- Solvable material
- Total hardness
- Iron
- Manganese



- Copper
- Zinc

The result of the test shall be submitted to the Engineer.

7.26.67 Air Conditioning and Ventilation Equipment Work

7.26.67.1 General

7.26.67.2 Scope

This clause covers the performance of all air conditioning and ventilation equipment works in accordance with the drawings and these specifications.

- (1) Air Conditioning Equipment
- (2) Ventilation Equipment

The contractor shall submit shop drawings of fabricated items to the engineer for approval. The shop drawings shall clearly show the details of fabrication, installations, dimensions, sizes, operation, methods of anchoring and any other pertinent details required for satisfactory installation. The contractor shall submit the result of tests at designated date specified.

7.26.67.3 Design Basis of Air Conditioning and Ventilation System

- (1) Outdoor

Maximum Temperature	36° C Dry Bulb
Minimum Temperature	28° C Wet bulb
Minimum Temperature	12° C Dry bulb

- (2) Indoor Temperature

25° C Dry bulb Control room

27° C Dry bulb Other rooms (summer)

22° C Dry bulb Other rooms (winter)

Humidity	60%	Control room
(Relative humidity)		Other rooms

7.26.67.4 Equipment and Materials

The equipment, materials and accessories as specified herein shall be furnished together with spare parts for three (3) years normal operation except as indicated otherwise.

7.26.67.5 Package Air Conditioning Units

- (1) The Contractor shall furnish and install the package air conditioning units as shown in the drawings. Package air conditioning units shall be factory built

and factory tested products.

(2) In this work, tow types of package air conditioning units shall be installed.

(3) Air heat source heat pump package air conditioner.

(a) Type Light weight, up right floor standing type.

(b) Cabinet Synthetic resin paint baked on finished plates.

(c) Insulation Insulation shall be installed to prevent sweating and to muffle sound, using glass wool on polywreten form.

(d) Condenser Air source heat pump condenser.

(e) Compressor Compressor (s) shall be serviceable hermetic type equipped with suitable rubber vibration isolators crank case heaters, liquid line strainer and suction and discharge shut off valves.

(f) Air Filter Permanent washable polyvinyl chloride.

(g) Heat Exchanger Multi pass cross fined tube.

(h) Connections With flare nut or companion flange for field piping.

(i) Outdoor Fan Propeller Fan.

(j) Evaporator Multi pass cross finned tube

(k) Evaporator Fan
Multi-brade centrifugal Fan
AC- 1 (see drawings) direct drive AC- 2 (see drawings) belt drive

(l) Applicable power supplies
AC 3-phase 400V 50Hz.

(m) Operation switch

3-position push button types and cooling heating selection switch (Ventilating operation, cooling operation or heating operation.

(n) High Pressure Switch

This switch cuts out the operation of compressor when the discharge pressure exceeds the setting.

(o) Accessories

Spare Parts

Refrigerant - for 1 change

V. belt - 1 each

7.26.67.6 Fans

- (1) The Contractor shall furnish and install the fans as shown in the drawings. Fans shall be factory tested products.
- (2) The capacities of the fans shall be in accordance with fan schedules as shown. Unless otherwise directed, the fans shall conform to the layouts as shown in the drawings.
- (3) All fans shall be statistically and dynamically balanced to avoid vibration and shall have blades to secure quiet efficient operation.

7.26.67.7 Ducts

Duct materials shall conform to the followings:

Galvanized steel iron sheet

Steel

Bolt

Nut

Gasket for flange

7.26.67.8 Refrigerant Pipe Materials and Accessories

- (1) The pipes shall be of copper. The material shall be as specified in JIS H3603 (Phosphorus deoxidized copper seamless pipes and tubes) and the dimensions shall be as specified in ASTM B8858L (Hard materials).
- (2) The joints shall be molded products made from the above materials and they shall pass the manufacturer's standards. In locations where removal is required, flared or flanged joints shall be provided.

7.26.68 Installation Work

7.26.68.1 Foundation Work

- (a) Foundation shall be of reinforced concrete construction and shall be able to withstand the weight of equipment and external forces by having sufficient bearing face. Moreover, the foundation shall be constructed on floor or ground having sufficient bearing capacity.
- (b) Cement to be used for foundation shall be the standard Portland cement in accordance with BDS 232 (Portland Cement).
- (c) In principle, the size of aggregate shall be the following values
Gravel : 25mm or less Grouded Stone :

20mm or less Sand : 2.5mm or less

Provisions other than those specified above shall be in accordance with the specifications for
“Reinforced Concrete Work”

7.26.68.2 Installation Work for Equipment(S)

All equipment's shall be firmly secured to the floor so that the equipment will not move or be damaged due to earthquakes, etc.

7.26.68.3 Duct Work

- (1) The Contractor shall furnish and install all sheet metal ducts for supply, return, fresh air and exhaust systems as shown in the drawings.
- (2) Ducts shall be constructed to standards outlined in the latest HASS Guide. Ducts shall be constructed of galvanized steel gauges as shown Table 13.1.

Table - 13.1

Duct Size	Metal Gauge	Thickness
Less than 450	#26	0.5mm
455 ~ 750	#24	0.6mm
755 ~ 1500	#22	0.8mm
1501 ~ 2250	#20	1.0mm
More than 2260	#18	1.2mm

- (3) The contractor shall clean all dirt and rubbish from the interior and exterior of all ducts and other accessories prior to erection.
- (4) A flexible connection shall be made between the fan discharge and the adjoining duct work.
- (5) Low-velocity ducts shall be installed as follows :

Table - 13.2 : Duct Flanges

Thickness	Shape Steel	Max. Pitch	Bolt		Rivet	
			Dia.	Pitch	Dia.	Pitch
0.5mm	25x25x3	3.6m	8.0mm	100mm	4.5mm	65mm
0.6	25x25x3	3.6	8.0	100	4.5	65
0.8	30x30x3	2.7	8.0	100	4.5	65
1.0	40x40x3	1.8	8.0	100	4.5	65
1.2	40x40x5	1.8	8.0	100	4.5	65

Table - 13.4 : Duct Hangers

Thickness	Shape Steel	Steel Rod Dia.	Max. Pitch
0.5mm	25 x 25 x 3	9mm	3.0m
0.6	25 x 25 x 3	9	3.0
0.8	30 x 30 x 3	9	3.0
1.0	40 x 40 x 3	9	3.0
1.2	40 x 40 x 5	9	3.0

(6) Spiral Duct

- (a) The straight portion of the spiral duct shall be fabricated, using a strip of the galvanized steel sheet. The nominal size of the spiral duct shall be based on the inside diameter. The tolerance in inside diameter shall be $+0 \sim +2$ mm in reference to the nominal size. The thickness of the iron strips to be used shall be as indicated in Table 13.5.

Table - 13.5 : Thickness of Spiral Duct

Air Duct Diameter (mm)	Thickness (Gauge No.) of iron strips
Below 200	0.5mm (#26)
Over 200, but below 600	0.6mm (#24)
Over 600, but below 800	0.8mm (#22)
Over 800, but below 1,000	1.0mm (#20)

The pitch of the side seaming at the straight portion of the spiral duct shall be as indicated in Table 13.6 and the folding width shall be over 6mm.

Table - 13.6 : Side Seaming pitch of spiral Ducts

Air Duct diameter (mm)	Seam Pitch (mm)
Below 100	Below 100
Below 1,000	Below 150

- (b) The jointing of one spiral duct to another shall be preformed by applying as many side seaming as required, using galvanized steel strips or welding as many steel strips arranged properly between spiral joints. The galvanized steel strips shall be applied, in advance, with rust preventive paint on both inner and outer sides.

The nominal size of spiral duct joints shall be based on the outside diameter of the spiral duct joints, and the tolerance in nominal size shall be as indicated in Table 13.7.

Table - 13.7 : Tolerance in spiral duct Joint Diameter

Nominal Size (mm)	Tolerance (mm)
Below 600	- 1.5 - 2.5

Over 600, but below 1,00	- 2.0 - 4.0

The thickness of the galvanized steel strips to be used for the joint between spiral air ducts shall be as indicated in Table 13.8.

Table - 13.8 : Thickness of Galvanized iron Strips and Steel Strips

Nominal Size (mm)	Thickness (Gauge No)
Below 200	0.6mm (#24)
Over 200, but below 600	0.8mm (#22)
Over 600, but below 800	1.0mm (#20)
Over 800, but below 1,000	1.2mm (#18)

The overlapping width between steel strips used for the spiral duct joint shall be as indicated in Table 13.9.

Table : 13.9 : Overlapping width between iron strips or steel strips

Nominal Size (mm)	Overlapping Width (mm)
Below 125	60
Over 125, but below 300	80
Over 300, but below 1,000	100

(c) Spiral duct reinforcement

The reinforcement for spiral ducts shall be as per Table 13.10.

Table : 13.10 : Reinforcement for Spiral ducts

Air Duct Diameter (mm)	Reinforcing angle steel	Mounting Interval (mm)	Rivet	
			Dia. (mm)	Pitch (mm)
Over 600, but below 750	30 x 30 x 3	Below 2,400	4.5	65
Over 750, but below 1,200	30 x 30 x 3	Below 1,800	4.5	65
Over 1,210	40 x 40 x 3	Below 1,200	4.5	65

(7) Air duct support

- (a) The hangers and supports for the rectangular air duct shall be made of shape steel or gal steel. The shapes and dimensions of the hangers and supports shall be as per Table 13.4

- (b) The hangers and the supports for the circular hanger shall be as per Table 13.12.

Table - 13.12 : Shape and dimensions of the hangers and supports for the circular air duct

		Hanger		Support	
Dia. Of circular air duct	Flat steel (mm)		Max. mounting interval	Flat Steel (mm)	Max. mounting Interval (mm)
Below 1,500	25x3	Bar steel with a size of 25x3 or 9mmø bar steel	2,700	25 x 3	2,700
Over 1,500	30x3	Bar steel with a size of 30x3 or 12mmø bar steel	2,700	30 x 3	2,700

- (8) A canvas sheet shall be used for the connection between the air duct and the air blower or between the air duct and the air exhauster so that the vibrations from the air blower or the air exhauster may not propagate to others.
- (9) Where the air duct is installed penetrating through a wall, a through part both on the wall side and the duct side shall be finished to a good appearance.
- (10) The checking access port shall be such as will allow the ease of opening and closing and shall permit air leakage. The access port cover shall be made of the galvanized sheet iron having the same thickness as that of the sheet iron for the air duct. Particularly, the access port cover at a location where the air from the air conditioner flows shall have insulating material to the thickness of more than 25mm.
- (11) After the installation, the interior of the air duct shall be cleaned thoroughly and checked if there is no interference in the air flow.
- (12) Outdoor air intake and exhaust louver

The outdoor intake louver and exhaust louver shall be made of the stainless steel sheet having the thickness of more than no. 20 gauge.

The effective area of the louvers shall be over 40%, and those louvers, which are installed at such locations where they are exposed to weather, shall be designed and manufactured to be of such a construction as will prevent rain

water from getting inside.

(13) Diffusers

- (a) The diffusers to be used shall have a good appearance, and they shall by no means be allowed to generate noises during system operation. In addition, the diffusers shall be designed to be capable of providing normal performance.

- (b) Universal Type diffuser

The mounting frame of the diffusers of this type shall be fabricated with steel or iron plate having a thickness of more than 1.0mm, and it shall have such a construction as the frame can be mounted to the air duct by means of bolts.

The diffuser blades shall permit the case of adjustment.

The shutter to be employed to the universal type diffuser shall be of the double access doortype.

Unless otherwise specified, the diffuser of any type shall be made of galvanized steel sheet and shall be finished with melamine resin baked on the surface of each diffuser unit.

- (c) The anemodiffusers to be used shall be used shall have sufficient air diffusing performance and they shall be provide with a damper and an air flow informing device.

7.26.68.4 Piping

(1) Cooling medium piping

- (a) The insides of the pipes shall be thoroughly cleaned and dried before use.

After cleaning the ends of the pipes shall be sealed by an appropriate method to prevent a foreign matter from entering during the piping work.

- (b) The pipes shall be normally cut perpendicular to the pipe center. The cutting shall be such that the pipe diameter is not decreased. The outer surfaces of connecting pipes and the inner surfaces of joints shall be polished sufficiently with a flux brush, etc. After the outer surface of the pipes is coated with flux, they shall be carefully inserted in the joints and fit perfectly while heating.

- (c) The discharge and intake gas tubes shall have a minimum downward gradient of at least 1:200.

- (d) The piping shall be performed in consideration of expansion and contraction.

- (e) In flanged joints, a packing of a thickness within 1.5 mm as specified in JIS R3453 (Compressed asbestos sheet) shall be used.
- (f) A by-pass between the pipe diameter and the same diameter shall be provided in cooling medium filters, automatic expansion valves, cooling medium solenoid valves, etc.
- (g) The pitch for hoist and support fixture's shall be as shown in table 13.3.4.

Table - 13.13 : Copper Pipe support pitch

Pipe support pitch	Nominal									
Diameter	6	8	12	16	20	25	32	40	50	65
	75	100	B							
Max.		1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.5
		2.5	3.0							
3.0 Pitch(m)										

- (h) To prevent the transmission of vibrations, anti-vibration joints, and anti vibration hoist and support fixtures shall be used.

7.26.68.5 Insulation Work

7.26.68.6 Materials

- (a) The contractor shall furnish and install all insulation materials required for ductwork as shown in the Drawings.
- (b) Specifications for heat insulation coverings.

Table - 13.14

Classification of heat insulation covering		Specifications
Heat insulation materials	Glass wool heat insulation	The glass wool heat insulation board shall be No. 2 40K stipulated in JIS A 9505 (Glass Wool Heat Insulation Material).
Exterior materials	Glass cloth	The glass clothes shall be the non-alkali plain weave clothes stipulated in EP 21C in JIS R3414 (Glass clothes) which have been made free from fraying.

	Aluminum	The glass clothes shall be the flat weave clothes made of aluminum foil with a thickness of 0.02 mm or over stipulated in JIS H 4160 (Aluminum and aluminum Alloy foils), to which the plain weave clothes made of 13 micron glass yarn and 200 single filament yarns according to JIS R3414 with a unit acrylic resin adhesive.

Table - 13.15

Classification of heat insulation coverings		Specifications
Auxiliary	Glass filament Rivet	The glass filament mat shall be made of glass yarn of materials 18 micron or less according to JIS R 3413 and have a unit mat weight of 45 g or over per m ² . The rivet shall be made of the washer made of galvanized steel plate to which a nail with a length to be changed depending upon the thickness of heat insulation materials is built in, or the copper plated nail for spot welding, and have a strength sufficient to bear the insulation materials.
	Steel frame	In principle, the steel frame shall be made of steel plate with a standard plate thickness of 0.4 mm or over as stipulated in JIS G 3302 (Galvanized sheets)
	Adhesive	In principle, the acrylic emulsion adhesive shall be used for bonding of glass clothes, glass filament mat and aluminum glass clothes, and the chloroprene rubber adhesive shall be used for bonding of rivet.

(3) Materials and procedures depending upon the types of heat insulation work.

Classification of insulation work	Order of insulation work
Insulation of exposed interior	1. Rivetting

	2. Heat insulation board with a thickness of 50mm
	3. Corner patch and seal-up
	4. Adhesive
	5. Glass clothes
Indoor concealing	1. Rivet
	2. Heat insulation board with a thickness of 25 mm
	3. Corner patch and seal-up
	4. Adhesive
	5. Aluminum Glass clothes

Note : The galvanized steel plate with a thickness of 0.2 mm or over shall be used for corner patch, and the glass filament mat shall be used for seal- up.

7.26.68.7 Execution

- (1) The mutual clearance between the respective insulation shall not include the thickness of exterior materials or auxiliary materials.
- (2) The mutual clearance between the respective insulation shall as small possible, and no overlapping joints shall be provided on the same line.
- (3) In principle, two rivets shall be driven into the lower and side surfaces and one rivet into the upper surface of the air duct at intervals of 300mm each.
- (4) The portion of air duct penetrating through the floor shall be covered with stainless steel from the floor surface to height of up to 150mm in order to protect the insulation
- (5) The outermost ends of the insulation shall be protected as required depending upon the materials and purpose of heat insulation.
- (6) Heat insulation work for inspection doors, etc. of equipment requiring such insulation shall be carried out so as not to cause hindrance during opening and closing of such doors, etc. nor deterioration of the said heat insulation.

7.26.69 Painting Work

7.26.69.1 General

- (1) All equipment and materials, except for the following , shall be painted.
 - (a) Surfaces other than galvanized surfaces
 - (b) Galvanized portions which are normally concealed
- (2) All equipment and materials requiring inspection shall be painted after inspection.

7.26.69.2 Painting

The types of paints and frequency of painting of the respective portions shall, in principle, be as specified in Clause 11.3.5 Unless specified in this table, such painting shall be carried out according to similar items taking into account the work purposes, materials and other conditions.

7.26.70 Tests

7.26.70.1 Piping

- (1) The refrigerator shall pass the air-tightness and pressure withstand tests.
- (2) The refrigerators shall be test operated in the factory and careful investigations concerning performance, noise, vibrations, etc. shall be performed. After it is confirmed that the tests have been passed, the refrigerator shall be shipped after applying rust- proof paint.
- (3) After installation, the refrigerators shall be test operated.
- (4) After completing of the refrigerant piping, an air-tightness test shall be performed using carbon dioxide, nitrogen, dry air, etc. After the air-tightness test, the entire system shall under-go high vacuum evaporation to remove all water. After this dehydration treatment, a cooling medium leak test shall be performed according to the inspection of the Engineer.

7.26.70.2 Duct

After completing the air duct installation, the air duct system shall have an air blow test in the presence of the Engineer. Unless otherwise specified, all of equipment, materials and execution shall be as stipulated in "Indoor Lighting System".

7.26.71 Secondary-Electrical Wiring

7.26.71.1 General

- (1) The contractor shall furnish and install the control panels, switches, receptacles, electrical conduit pipes, wires, outlet box for secondary wiring equipment as shown in the Drawings.
- (2) Motors used in cooling equipment, blowers pumps, etc. shall all be included in this equipment work.
- (3) Unless otherwise specified, the wire conduit and wiring work in the primary side shall all be performed as separate electrical equipment work. However :
 - (a) Secondary side wire conduit and wiring work for cooling equipment operating panels and below shall all be part of the work of the equipment concerned.
 - (b) Wire conduit and wiring work related to the automatic control of air

conditioning equipment shall all be part of the work of the equipment concerned.

- (c) Insufficient water level alarm equipment for water supply tanks, etc. shall be a part of the work of the equipment concerned.

(4) Unless otherwise indicated in this clause, all of equipment, materials and execution shall be as stipulated in “Indoor Lightning Plug and Telephone Piping System”
7.26.71.2 Equipment And Materials

- (1) Cables shall be as shown in Table - 14.1.

Table - 14.1(1)

Items	Code No	Type	Letter
Control cable CVV	JIS C3401	Polyvinyl Insulated Sheathed control	Chloride

Cables

Cross-linked Polyethylene Insulated Cable	JIS C3606 Polyethylene CV	Cross-linked

- (2) The electrical equipment and materials shall meet the standards of the Japanese Electrical Manufacturers Association (JEM) in addition to these specifications.

- (3) Motors

- (a) Unless otherwise specified, AC motors shall meet the specifications in Table 14.2.

Motor Specifications	JIS 4201	Low-Voltage Three Phase Induction
Motor Voltage	400 V	
Insulation class	E	

- (b) Three-phase induction motors shall be those using the starting equipment in Table 14.3 as standard.

Table 14.3

Area Capacity(kw)	Refrigerating equipment		Blowers	
	Motor	Starting system	Motor	Starting system
37 or more	High voltage wound type	Resister	High voltage wound type	Resister
15 ~ 37	Low voltage special	Y-A	Low voltage special squirrel	Y-A
11 ~ 15	Low voltage special squirrel	Y-A	Low voltage special squirrel	Y-A
5.5 ~ 7.5	Low voltage special squirrel	Direct starting	Low voltage special squirrel	Direct starting
37 or less	Low voltage normal type	Direct starting	Low voltage normal type	Direct starting

7.26.71.3 Test

Upon completion of the work, the whole system shall be proved acceptable by inspections carried out by the Engineer.

7.26.71.4 Lighting, Plug and Telephone Piping System Principle of Lighting

The essential features of an efficient lighting system are :

- visual comfort through adequate illumination of the working surface, prevention of glare, and avoidance of shadows,
- ease of maintenance.

The design of a lighting system shall involve :

- a) careful planning of the brightness and colour pattern within both the working areas and the surroundings so that attention is drawn naturally to the important areas, detail is seen quickly and accurately, and the room is free from any sense of gloom or monotony,
- b) use of directional lighting to assist perception of task detail,
- c) controlling direct and reflected glare from light sources to eliminate visual discomfort,
- d) minimizing flicker from certain types of lamps and paying attention to the colour rendering properties of the light,
- e) the correlation of lighting throughout the building to prevent excessive differences between adjacent areas, so as to reduce the risk of accidents, and
- f) the installation of emergency lighting systems, where necessary.

7.26.71.5 Scope of Work

Concealed Electrical wiring by Eastern/BRB cable or equivalent

- European Made MK type Gang switch, socket MCB etc
- Provision for Internet facilities system, Telephone & Intercom wiring.
- Sufficient Earthlings facilities.
- To be used LED Light.

The scope of work under the contract includes supply and installation of lighting

fixtures, lighting panel, switches, receptacles, electrical conduit pipes, wires, outlet boxes for telephones, internet, dish cable and other necessary accessories for the indoor lighting system.

7.26.72 Design Conditions

7.26.72.1 Illumination Level

- 1) The illumination levels for each room shall be as shown in Table - 15.2.1.

Table - 15.2.1

Name of Room	Normal condition	Emergency condition
Control	500 lx	50 lx
Office	300 lx	10 lx
Relay	300 lx	10 lx
PLC/ SCADA	500 lx	50 lx
Conference	300 lx	10 lx
Battery	100 lx	5 lx
Rectifier Set	100 lx	5 lx
Corridor	100 lx	5 lx
Pump Control	100 lx	5 lx
Cable Control	50 lx	5 lx
B/G	200 lx	5 lx
Lavatory	100 lx	-
Kettle	100 lx	-

- (2) Setting Height
 - (a) Lighting fixtures Refer to Design Drawings.
 - (b) Switches
1.25 meters above the floor level, unless otherwise specified.
 - (c) Receptacles
0.3 meters above the floor level, unless otherwise specified.

- (3) Power source voltage

- (a) For lighting panel

AC 3 phase 4 wires 415/230 V 50

Hz DC 2 Wires 110 V

- (b) For normal lighting, convenient outlet and ventilation equipment.

AC 1 phase 2 wires 220 V 50 Hz

- (c) For emergency lighting

DC 2 Wires 110 V

7.26.72.2 System Description

- (1) AC, DC Source and earthing shall be supplied from the primary side.
- (2) Standard LED Lamps shall be provided for the control room and all miscellaneous rooms, and shall be designed to be manually activated by means

of the switches at the entrance of each room. The lamps in the corridor, Toilet room, office and all electrical rooms shall be sensor based which will automatically switched “ON” and off.

- (3) LED Lamp/Incandescent lamps shall be provided in all parts of the control building to serve as emergency lighting. The lamps in the control room, corridor, office and all electrical rooms shall be automatically switched “ON” in case of AC failure.
- (4) Outlet boxes for telephones shall be provided for the control room, together with piping from the outlet boxes to the cable tray in the cable control room. The siting of the telephones and wiring shall be included in the electrical scope of work of Lot IV.
- (5) Exit sign light

The exit sign lights shall be mounted above the all exits of the control building.

- (6) Spare parts, as indicated below, will be supplied for three (3) years normal operation.

7.26.72.3 Equipment's and Materials

7.26.72.4 Wires

Wires shall be as shown in the Table 15.4.1

Table - 15.4.1

Item Code	No. T	
type Letter		
Vinyl wire	JIS C3307	600 Grade Polyvinyl
Chloride Insulated Wires		
Heat- resistant	JIS C3317	Heat- resistant vinyl
Insulated wire	HIV	

HIV wires shall be used in the DC circuit.

7.26.72.5 Wire Connectors

Wire connectors for indoor wiring shall be in accordance with JIS C2810 or equivalent BDS

7.26.72.6 Metal Conduit and Fittings

Metal conduit and fittings shall be in accordance with the Table 15.4.3, and the conduit shall be of heavy gauge type.

Table 15.4.3

Item	Code No.	Designation
Conduit	JIS C8305	Rigid metal Conduit(heavy gauge)
Coupling	JIS C8330	Couplingfor Rigid Metal Conduit
Normal Bend	JIS C8330	Elbows for Rigid Metal conduit
Bushing	JIS C8331	for Rigid metal Conduit Bushing
Locknut	JIS C8333	for Rigid Metal Conduit
Saddle	JIS C8334	Saddles for Rigid Metal Conduit

Locknuts Universal	JIS C8335	Universal Fittings for Rigid metal
Outlet Box	JISC8337	Boxes for Rigid metal Conduit
Switch Box	JISC8337	Boxes for Rigid Metal Conduit
Concrete Box	JIS	C8338 Conduit Out Switch
Boxes for Rigid Metal Conduit covers for Rigid Metal Conduit		Concrete Box Cover JIS C8339
Insulated Bushing for rigid Metal Conduit	JIS	C8347 Insulated Bushing

7.26.7.2.7 Pull Boxes

Pull boxes shall be made of steel and coated with protective paint, and wherever exposed to view, shall be coated with a finish paint of a color approval by the Engineer.

7.26.7.2.8 Wiring Devices

Wiring devices shall be in accordance with the Table-15.4.5

Table-15.4.6

Items	Code No.	Designation
Fluorescent Lamp General Lighting Service	JIS C7601	Fluorescent Lamps for
Rapid Start cathode Discharge Fluorescent Lamps (40 W type)	JIS C7602	Instantaneous Start Hot
Glow Starter fluorescent Lamps (Less than 40 W type)	JIS C7607	Glow starters for
Fluorescent fixture ballasts for Fluorescent lamps	JIS C8106	Fluorescent Lamps Lighting Fitting for
Incandescent lamp Lamps	JISC7501	General Use for Double Filament

7.26.7.2.9 Lighting Fixtures

- In Principle shapes and dimensions shall be in accordance with the Drawings. Catalogs and shop drawings shall be submitted to the Engineer for approval.
- Lighting fixtures for emergency use shall be as specified by BCJ (Articles

rated by the Building Center of Japan), or approved equal.

7.26.72.10 Lighting Panel

Shapes, electrical characteristics, types capacities of circuit breakers, and the system of operations shall be in accordance with the Drawings.

The panel shall be made of steel plate with a thickness of more than 1.6mm (body) and 2.3 mm (door) respectively.

The finish shall be painted with a color approved by the Engineer. Catalogs and shop drawings shall be submitted to the Engineer for approval.

7.26.72.11 Over Current Protectors

Molded case circuit breakers and residual current protective devices shall be of European Standard used in the lighting panel

7.26.73 Indoor Wiring

7.26.73.1 Rigid Metal Conduit

(1) Installation

- (a) Imbedding or conduit laying shall be so made that the strength and structure of the building is not affected.
- (b) Cut ends of conduit shall be neatly and smoothly finished by instrument such as a reamer.
- (c) Conduit shall be bent at a radius of more than six (6) times the internal diameter of the conduit. Conduit running between outlets and pulling boxes shall not have more than the equivalent of four 90° bends.
- (d) A pull box or junction box shall be installed to protect conduit exceeding 30 meters in length and at the points required.
- (e) In general, a switch or outlet box shall be used at all points where a switch, receptacle (socket) or lighting fixture is to be provided.
- (f) Where low voltage metal conduit is enclosed in proximity to or crosses communication wiring, metallic water pipe or gas pipe, the work shall be so done that direct contact is avoided.

(2) Connection of conduits

Conduit and fittings shall be perfectly connected, both physically and electrically, and the conductor resistance shall be preferably kept within 2 ohms between grounding conductor and the end metal conduit.

(3) Pull Boxes and Junction Boxes

- (a) Shape and type of these boxes shall suit the place of installation and a steel plate or more than 1.2mm in thickness shall be used.
- (b) Boxes shall have adequate dimensions well matching the number or conduits connected and the condition of connecting or pulling wires.
- (c) Where the box is covered or concealed in structural material, access to the box shall be made possible to facilitate inspection.

(4) Installation of feeder conduits

- (a) Exposed main conduit shall, in principle, run parallel with wall or ceiling.
- (b) Metal supports for conduit in concrete building shall have a proper fixing insert or bolt previously embedded in the concrete.
- (c) Spacing between metal inserts or bolts to support conduit shall in principle, be approximately 2 meters.

(5) Painting, Protection and cleaning of Conduit

- (a) Where the plated or painted surface of conduit, metal support or box has peeled off, it shall be touched up with protective paint.
- (b) Conduit shall be sufficiently protected against entry of moisture, water, dust etc. and the cut end of conduit shall be bush be capped, wood plugged or covered with rag, etc.
Whenever concrete work is in progress.
- (c) Conduit and boxes shall be well cleaned and the conductivity checked after removal of the forms.

(6) Wire Pulling

- (a) Connection of wire shall not be made inside metal conduit. Connection shall be made in metal box, junction box or distribution board.
- (b) Wire shall be pulled through conduit after the inside of conduit has been cleaned and when each of conduit has been capped with bushing. Cleaning shall be performed in such a manner that walls, ceilings, etc. around the conduit are not stained or spoiled in any way.
- (c) In all cases, all wires stemming from one circuit shall be accommodated in the same conduit for A.C circuit work, except where a balanced condition is electro-magnetically attained by accommodating both lines of the same polarity within the same conduit.

7.26.73.2 Installations

7.26.73.3 Installation of Lighting Fixtures

- (a) Heavy lighting fixtures shall be firmly supported using inserts, studs or bolts, attachments and if necessary shall be provided with a means to prevent swinging by using wood screw, etc.

- (b) Lighting fixtures shall be installed horizontally or vertically in a workmanlike manner and shall be so located as to not interfere with inspection of related equipment.

7.26.73.4 Installation of Lighting Panel

Lighting panel shall be installed firmly on walls or other surfaces in a workmanlike manner, and shall be so located as to not interfere with inspection of related equipment.

7.26.73.5 Test

A performance test shall be made after installation of equipment has been completed.

7.26.74 Grounding

7.26.74.1 Grounding Resistance

Grounding resistance shall be 10 ohms or less, unless otherwise specified.

7.26.74.2 Electrical Works to Be Grounded

Except for specific instances, all electrical that the respective grounding resistance values are kept at specified values throughout the year despite seasonal changes.

- (a) No grounding is required for steel base, metal box and steel frame of equipment is operated on less than AC150 V (Voltage to ground) and is installed at a dry location.
- (b) Metal conduit and metal accessories
- (c) Metal enclosure accommodating the discharge lamp ballast and the metal parts or a discharge lamp lighting fixture, except where grounding is required and/or when so directed by Engineer, shall be grounded.

7.26.74.3 Sign, Signal & Annotation:

- Integrated Design of Different kind of Indicators like- Acrylic Sign Board, LED Sign Board, Neon Sign Board, Reception Sign Board, Safety Sign, PVC Letters, Glow Sign Board, Customized Display Boards, Overhead Signage, Metal Nameplates, Commercial Sign Boards, Outdoor Signs, Electronic Sign Boards etc. should be provided in the design & construction.
 - Digital LED Signboard with the features of excellent visibility (even in daylight); Good quality at reasonable price and light weight; Simple installation, Safe to touch and clean; Changing color for attracting attention; Extremely low power consumption.
 - Should be provided the Accessories like Adaptor and chains etc.
- LED display screen shall be minimum 1.0 square meter. Shall be Compatible with IP65. Shall be installed at the front side wall of the building
- Environmentally friendly display it ensures lower power consumption and longer lifetime.

7.27 INSPECTION AND TESTING

7.27.1 33 KV OUTDOOR TYPE VCB AND PCM PANEL

Inspection and testing before and after shipment/ supply shall be **in accordance with the relevant IEC standard.**

7.27.1.1 Technical Orientation and Quality Test Witness (Acceptance Test)

The Purchaser shall have the right to inspect/test the goods/materials to confirm their conformity to the specification. The purchaser shall be entitled at all reasonable time during manufacture to inspect, examine and test of goods/materials at the manufacturers' premises, workmanship and performance.

The following tests (**not limited to**) shall be carried out for outdoor type VCB and PCM Panel as per latest version of IEC Standard or unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available: -

- a) Dielectric test on the main circuit
- b) Tests on auxiliary and control circuits
- c) Measurement of the resistance of the main circuit
- d) Tightness test
- e) Design and visual (physical) checks
- f) Electrical and mechanical operation test
- g) Verification of Protection system

The Supplier shall, after consulting the purchaser, give notice to the Purchaser in writing of the date and the place where the material or equipment will be ready for quality witness testing. When the purchaser intends to attend the test he shall promptly inform the supplier accordingly in writing, so that he can take action. The purchaser shall give the supplier timely notice in writing of his intention to attend the test.

Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These tests shall be performed as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract and only routine tests as agreed upon will be performed. As and when the purchaser is satisfied that any materials/ equipment's shall have passed the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect.

Should any inspected/ tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the items or complete batch if necessary. In that case Supplier has to replace the equipment and to make good of them and the supplier shall conduct similar pre-delivery Inspection and factory tests without any financial involvement to the purchaser. In case any of the Equipment found not conforming to the specification at the time of post landing Inspection, the supplier will in no way be relieved from the responsibility of replacing

them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

NESCO's Inspection Team of **3 members (Nominated by NESCO)** shall have to conduct Technical Orientation and Quality Test Witness at the manufacturer's factory premises. The cost incurred for this purpose shall be borne by the contractor and shall be deemed the cost in this regard is included in the offered price.

During factory inspection and test witness, transfer of Technology and Technical know-how regarding spares, parameters and testing procedure including familiarization/ testing of equipment to NESCO Engineers is to be performed as per Section 7: Technical Section/as per relevant standard. Other than this the supplier shall bear (applicable for overseas factory) the round air tickets, hotel accommodations, per diem allowances, internal transportations and out of pocket expenses @ US\$ 100.00 per person per day for **07 days (excluding travel time)** for the witnessing of manufacturing process and tests of concerned equipment at manufacturer's works. All the cost of this purpose shall be deemed is included in the offered price. They will participate on the quality acceptance test (QAT) for the offered equipment (to be supplied from abroad).

No goods shall be packed, prepared for shipment/delivery unless it has been approved and written instruction have been received by the Purchaser. The bidder has to mention the place of Technical Orientation and Quality Test Witness in the following table:-

Sl. No.	Item	Period of Technical Orientation and Quality Test Witness	Place & Country of Technical Orientation and Quality Test Witness

7.27.2 33 KV CURRENT TRANSFORMER, 33 KV POTENTIAL TRANSFORMER, 33 KV LIGHTENING ARRESTER, 33 KV ISOLATOR OF ALL TYPES

Inspection and testing before and after shipment/ supply shall be in accordance with the relevant IEC standard.

7.27.2.1 Technical Orientation and Quality Test Witness (Acceptance Test)

The Purchaser shall have the right to inspect examine and test the goods/materials to confirm their conformity to the specification. The purchaser shall be entitled at all reasonable time during manufacture to inspect, examine and test of goods/materials at the manufacturers' premises, workmanship and performance.

The Routine test shall be carried out as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract at the manufacturer premises or other places where the test facilities are available.

The Supplier shall, after consulting the purchaser, give notice to the Purchaser in writing of the date and the place where the material or equipment will be ready for quality witness testing.

When the purchaser intends to attend the test he shall promptly inform the supplier accordingly in writing, so that he can take action. The purchaser shall give the supplier timely notice in writing of his intention to attend the test. Where the supplier provides for tests on the premises of the supplier or of

any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These tests shall be performed as per latest version of relevant IEC/ BS or equivalent international standards as mentioned in the contract and only routine tests as agreed upon, will be performed.

As and when the purchaser is satisfied that any materials/ equipment's shall have passed the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect.

Should any inspected/ tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the items or complete batch if necessary. In that case Supplier has to replace the equipment and to make good of them and the supplier shall conduct similar pre-delivery Inspection and factory tests without any financial involvement to the purchaser. In case any of the Equipment found not conforming to the specification at the time of post landing Inspection, the supplier will in no way be relieved from their responsibility of replacing them or making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

NESCO's Inspection Team of **3 members (Nominated by NESCO)** shall have to conduct Technical Orientation and Quality Test Witness at the manufacturer's factory premises. The cost incurred for this purpose shall be borne by the contractor and shall be deemed the cost in this regard is included in the offered price.

During factory inspection and test witness, transfer of Technology and Technical know-how regarding spares, parameters and testing procedure including familiarization/ testing of equipment to NESCO Engineers is to be performed as per Section 7: Technical Section/as per relevant standard. Other than this the supplier shall bear (applicable for overseas factory) the round air tickets, hotel accommodations, per diem allowances, internal transportations and out of pocket expenses @ US\$ 100.00 per person per day for **07 days (excluding travel time)** for the witnessing of manufacturing process and tests of concerned equipment at manufacturer's works. All the cost of this purpose shall be deemed is included in the offered price. They will participate on the quality acceptance test (QAT) for the offered equipment (to be supplied from abroad).

No goods shall be packed, prepared for shipment/delivery unless it has been approved including factory Test reports and written instructions has been issued by the Purchaser.

The bidder has to mention the place of Technical Orientation and Quality Test Witness in the following table:-

Sl. No.	Item	Period of Technical Orientation and Quality Test Witness	Place & Country of Technical Orientation and Quality Test Witness

7.27.3 33KV CABLE TERMINATION, CONTROL CABLE, ACSR MARTIN CONDUCTOR, ACSR GROSBEAK CONDUCTOR, STEEL STRUCTURE.

The Purchaser shall have the right to inspect/test the goods/materials to confirm their conformity to the specification. The purchaser shall be entitled at all reasonable time during manufacture to inspect, examine and test of goods/materials at the manufacturers' premises,

workmanship and performance.

At least the following test along with routine test shall be carried out as per latest version of IEC Standard or equivalent IEEE standard or BS standard unless otherwise mentioned at the manufacturer premises or other places where the test facilities are available:-

1. Measurement of Electrical Resistance of conducts.
2. High voltage test
3. Partial discharge test
4. Capacitance test
5. Voltage test on cable serving
6. Measurement of dimension of insulation and conductor

The Supplier shall, after consulting the purchaser, give the Purchaser reasonable notice in writing of the date and the place at which any material or equipment will be ready for testing as provided in the contract and unless the purchaser shall attend at the place so named on date, which the supplier has stated in his notice, the supplier may proceed with the tests, which shall be deemed to have been made in the purchaser's presence, and shall forth with forward to the purchaser duly certified copies of test readings.

When the purchaser intends to attend the test he shall promptly inform the supplier accordingly in writing, so that he can take action. The purchaser shall give the supplier timely notice in writing of his intention to attend the test. The contractor shall submit the factory test report to the engineer for check and verification at least 15 days prior to inspection. Where the supplier provides for tests on the premises of the supplier or of any manufacturer of the supplier, except where otherwise specified, shall provide free of charge such assistance, labor, materials, electricity, fuel, stores, apparatus and instruments as may be requisite and as may be reasonably demanded to carry out such test efficiently. These test shall be performed as per relevant IEC Standard or equivalent IEEE standard or BS standard only routine tests as agreed upon, will be performed. As and when the purchaser is satisfied that any materials/equipment shall have passes the tests referred to in this clause, purchaser shall notify the contractor in writing to that effect. Should any inspected/tested goods fail to conform to the specification, the Purchaser shall have the right to reject any of the item or complete batch if necessary. In that case Supplier have to replace the Equipment and to make good of them without any financial involvement to the Purchaser. In case any of the Equipment found not conforming with the specification at the time of post landing Inspection, the supplier will in no way be relieved from their responsibility of replacing them on making them good at their own cost, despite the Equipment were found good at the time of Factory Acceptance Test. Nothing in this clause shall in any way release the supplier from any warranty or other obligations under the contract.

NESCO's Inspection Team of **3 members (Nominated by NESCO)** shall have to conduct Technical Orientation and Quality Test Witness at the manufacturer's factory premises. The cost incurred for this purpose shall be borne by the contractor and shall be deemed the cost in this regard is included in the offered price.

During factory inspection and test witness, transfer of Technology and Technical know-how regarding spares, parameters and testing procedure including familiarization/ testing of equipment to NESCO Engineers is to be performed as per Section 7: Technical Section/as per relevant standard. Other than this the supplier shall bear (applicable for overseas factory) the round air tickets, hotel accommodations, per diem allowances, internal transportations and out of pocket expenses @ US\$ 100.00 per person per day for **07 days (excluding travel time)** for the witnessing of manufacturing process and tests of concerned equipment at manufacturer's works. All the cost of this purpose shall be deemed is included in the offered price. They will

participate on the quality acceptance test (QAT) for the offered equipment (to be supplied from abroad).

No goods shall be packed, prepared for shipment/delivery unless it has been approved and written instruction have been received by the Purchaser.

The bidder has to mention the place of Technical Orientation and Quality Test Witness in the following table:-

Sl. No.	Item	Period of Technical Orientation and Quality Test Witness	Place & Country of Technical Orientation and Quality Test Witness

7.27.4 POST-LANDING INSPECTION AND TESTING:

The Supplier shall inform the purchaser immediately after arrival of the goods at the designated store of NESCO (as per delivery schedule). An Inspection team of NESCO shall perform the post-landing inspection in presence of supplier's representative. The Supplier shall arrange the program of post-landing inspection. Any defect or damage have been found at post-landing inspection, the defective or damaged materials/ goods to be replaced by the supplier at his own cost within the stipulated time. **The goods/materials shall be under the custody of the contractor for installation. The contractor shall be responsible for all types of safety and security of the inspected materials**

The purchaser's right to inspect, test (where necessary) and reject the goods after delivery at the designated store of NESCO shall in no way be limited or waived by reason of the goods having previously been inspected, tested and passed by the purchaser prior to the good's delivery.

The Inspection team will check the physical conditions and quantity of the goods delivered. If necessary, the inspection team will select the sample of good(s) and sent the selected sample goods to CERS, BPDB or BUET/ CUET/ KUET /RUET (as selected by the inspection team) to carry out the test(s) as per contract to confirm the conformity to the approved Technical Specifications, Guaranteed Technical Particulars (GTP), drawings and relevant standards. If the tested sample(s) fail to confirm the specifications in tests, the full consignment will be rejected. All cost of testing of Materials/ Goods including carrying, loading, un-loading etc. will be borne by the supplier.

7.27.5 THIRD PARTY INSPECTION:

- a) For any reason, if purchaser's/Employer's representative(s) cannot attend above mentioned "Witnessing of manufacturing process and tests of the equipment at manufacturer's works including transfer of technical know-how" program, a Third Party Inspection Company/Agency shall conduct/ witness Pre-shipment Inspection as well as Factory Acceptance Tests as per Contract and relevant standard at the manufacturer's Premises with the concurrence of NESCO. The Third Party Inspector shall submit a comprehensive report to purchaser with recommendation accompanied with photograph and video clips with date and time of the Equipment/Materials/Goods inspected within 7 days after completion of respective inspection/Test. After approval of third-party Inspection report by NESCO, shipping advice shall be issued to

Supplier/Contractor.No Equipment/Materials/Goods shall be shipped without shipping advice.

- b) The inspections/Tests shall be performed on as-needed basis as per schedule provided by the respective manufacturers.
- c) Supplier/contractor/manufacture shall not claim any additional cost for third party inspection. But if the cost is less than the regular cost of PSI/FAT by NESCO's representatives, then the excess bill will be deducted from final bill.
- d) The third-party inspection company/agency must not be involved in design, procurement, fabrication, construction and installation under this contract.
- e) Contractor/Supplier shall propose any of the following companies/agencies as Third Party Inspector:
 - 1. BUREAU VERITAS
 - 2. SGS
 - 3. Black and Veatch
 - 4. Mott MacDonald
 - 5. TUV SUD
 - 6. Lloyd Inspection Agency
 - 7. Intertek group
 - 8. Any other internationally accredited, independent & reputed inspection company/agency with global presence having minimum 05 years experiences as third-party inspection company/agency and related activities in the major Engineering Industries can be selected. In addition, Inspection Company / agency must be a member of the international federation of inspection agency (IFIA)/ TIC Council must have valid accreditation certificate for ISO 9001 and ISO/IEC 17020 and experience in successful completion of the similar test activities for relevant item.
- f) With the approval of NESCO, contractor/supplier shall engage third party inspection company/agency. The Third-Party Inspection is applicable for Equipment/Materials/Goods manufactured outside Bangladesh. NESCO reserves the right to revise the above-mentioned list.

Nothing in this clause shall in any way release the supplier from any warranty or other obligation under the provisions of the contract/ purchase order.

7.28 PRE-COMMISSIONING TEST OF SUBSTATION

(Test reports and documents required for substation commissioning)

7.28.1 Circuit Breaker (33 kV):

- 1. Name plate data
- 2. Insulation Test (Insulation resistance & DAR across open contact, Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
- 3. Closing/Opening operation check from Remote & Local, Closing Interlock check, Anti-pumping operation check
- 4. Closing/Opening timing check
- 5. Contact resistance check
- 6. Spring charge operation check, heating and illumination circuit functionality check

7.28.2 CT/PT (33 kV):

1. Name plate data
2. Insulation Test (Insulation resistance & DAR across Primary to Ground, Secondary to Ground, Primary to Secondary, Secondary 1 to Secondary 2, Phase to Phase etc. with minimum 5 kV test voltage for primary and 500 V test voltage for secondary / Power frequency withstand test (Hipot)/ Leakage current test/ tan δ test etc.)
3. Polarity & Ratio test
4. CT magnetization curve test
5. CT secondary winding resistance check

7.28.3 Control & Relay Protection Panel (33 kV):

1. Name Plate Data
2. Complete Relay test (Over current & Earth fault relay, Directional Over current & Earth fault relay (if applicable), Differential relay etc.
3. Primary injection test (Tripping & indication test of Over current & Earth fault relay, CT core allocation check, Single point earthing check)
4. Differential relay & Restricted Earth Fault relay tripping, indication and stability test
5. Master Trip relay, Trip circuit supervision relay, DC/AC fail relay and all other auxiliary relay functionality check
6. Closing/Opening operation check from CP & SCADA, Closing Interlock check, Anti-pumping operation check
7. Trip logic test
8. Alarm and indication circuit functionality check, Indicative meter and Energy meter check
9. Heating and illumination circuit functionality check
10. Wiring/ Ferrule Number/ Color Coding check as per drawing

7.28.4 Disconnecting Switch/Isolator/Earthing Switch (33 kV):

1. Name plate data
2. Insulation Test (Insulation resistance & DAR across open contact, Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)
3. Contact resistance check
4. Closing/Opening operation check, Mechanical Interlock check

7.28.5 Busbar (33 kV):

1. Busbar details (Size, Type and Capacity etc.)
2. Insulation Test (Insulation resistance & DAR across Phase to Ground, Phase to Phase etc. with minimum 5 kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test etc.)

7.28.6 Underground Cable & Line Conductor (33 kV):

1. Underground Cable & Line Conductor details (Size, Type and Capacity etc.)
2. Insulation Test (Insulation resistance, DAR & PI across Phase to Ground, Phase to Phase etc. with minimum 5

kV test voltage / Power frequency withstand test (Hipot)/ Leakage current test/ tan δ test (for cable only) etc.)

3. Phase Sequence Check

7.28.7 Earthing Resistance Measurement (Desired value < 0.35 Ω):

1. Substation mesh earthing
2. CRP panel & Switchgear panel earthing
3. 33 kV CB/CT/PT/LA/Isolator etc. earthing

7.28.8 Attachments:

1. Approved Equipment Layout Drawing (33 kV Switchyard, Control Room).
2. Approved Single Line Diagram along with relay model, CT ratio and load.
3. Approved Schematic diagram of CRP panel and Switchgear panel.
4. Approved General Arrangement (GA) drawing of Front View, Rear View, LHS view, RHS view of the panel.
5. Fault level calculation, CT sizing calculation.
6. Trip Matrix along with detail relay settings and related calculation for Line Feeder, Transformer feeder, Incomer Feeder and Outgoing Feeder.

NB:

1. The above-mentioned information and reports must be submitted to the office of the Superintending Engineer, Design & Inspection, NESCO Ltd., Rajshahi at least **15 days** before the expected date of commissioning. Softcopy of the requested information and documents will have to be emailed to design.inspection@nesco.gov.bd, se.sp@nesco.gov.bd, se.procurement@nesco.gov.bd
2. The pre-commissioning test must be witnessed by NESCO engineers and must be signed by the testing team members and witnesses.
3. Description of the test equipment for each test shall be mentioned.
4. The relay settings have to be finalized as per NESCO's recommendation.

7.29 DOCUMENTS AND DRAWINGS TO BE SUBMITTED WITH BID

7.29.1 TEST REPORT ON 33KV SWITCHGEAR (OUTDOOR VCB WITH PCM):

Type Test Certificates & Reports for offered type similar or higher Ampere rating Outdoor Vacuum Circuit Breaker for same voltage class from any **short-circuit testing liaison (STL) Member** [http://www.stl-liaison.org/web/03_Members.php] Testing Organization or Laboratory as per relevant IEC standard. Testing place must be at STL member organization's own laboratory. If testing place is not at STL member organization's own laboratory, the type test report will not be accepted. If witness/observer from the representative of STL member organization's signs type test report which is tested at non STL laboratory that will also be

unacceptable. The type test report along with results shall include **at least** the following tests:

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

Manufacturer's authorization for Protective Relays from ABB (Switzerland/ Sweden/Finland) or Siemens (Germany) or Schneider Electric (UK/France) or ALSTOM (UK/France), SEL, USA & Energy Meters from Siemens (Germany/Switzerland) or AEG (Germany) or ABB (Switzerland/Finland) or Itron (USA) or Elster (USA/Romania) or Landis+ Gyr (Switzerland/Greece) or Toshiba (Japan) or Honeywell (USA) or CEWE (UK) or it's equivalent in prescribed Form (PG5A-5).

7.29.2 TEST REPORT ON 33KV ISOLATOR:

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

- i. short time & peak withstand current test.
- ii. Resistance measurement test of main circuit.
- iii. Temperature rise test.
- iv. Lightning Impulse Voltage withstand test.
- v. Dielectric test on main circuit & control circuit test.
- vi. Operating and mechanical endurance test.
- vii. Partial discharge test.

7.29.3 TEST REPORT ON 33KV OUTDOOR TYPE CURRENT TRANSFORMER:

Type Test Certificates & Reports for offered type similar or higher Ampere rating CT for same voltage class from **any short-circuit testing liaison (STL) Member** [http://www.stl-liaison.org/web/03_Members.php] **Testing Organization or Laboratory** as per relevant IEC standards.

- a) Short time current tests
- b) Lightning Impulse withstand Test
- c) High Voltage Power Frequency Withstands Voltage Test
- d) Temperature Rise tests
- e) Wet test for outdoor CT
- f) Determination of errors or other characteristics according to the requirements of the appropriate designation and accuracy class
- g) Instrument Security Factor Test.
- h) Inter Turn Overvoltage Test.

7.29.4 TEST REPORTS FOR 33KV SURGE ARRESTER (LA)

Type Test Certificates & Reports for offered type similar or higher Nominal Discharge current rating Surge Arrester (LA) for same voltage class from any short-circuit testing liaison (STL) Member [[http://www.stl-liaison.org/web /03_Members.php](http://www.stl-liaison.org/web/03_Members.php)] Testing Organization or Laboratory as per relevant IEC standard. If testing place is not at STL member organization's own laboratory, the type test report will not be accepted. If witness/observer from the representative of STL member organization's signs type test report which is tested at non STL laboratory that will also be unacceptable.

The type test report along with results shall include at least the following tests :

- i. Insulation withstand test on the arrester housing.
- ii. Residual voltage test.
- iii. Step current impulse residual voltage test.
- iv. Lightning impulse residual voltage test.
- v. Switching impulse residual voltage test.
- vi. Long duration current impulse withstand test. iv. Operation duty test.
- vii. High-current impulse operating duty test.
- viii. Switching surge operating duty test.
- ix. Short-circuit test.
- x. Internal partial discharge test.
- xi. Bending moment test.
- xii. Environmental test.
- xiii. Seal leak rate test.
- xiv. Radio interference voltage (RIV) test.

7.29.5 33 KV OUTDOOR TERMINATION:

Complete Type test report on 33 kV Cable Accessories as per IEC shall have to be submitted. Test reports shall be submitted from any short-circuit testing liaison (STL) Member [[http://www.stl-liaison.org/web /03_Members.php](http://www.stl-liaison.org/web/03_Members.php)] Testing Organization or Laboratory as per relevant IEC standard. If testing place is not at STL member organization's own laboratory, the type test report will not be accepted. If witness/observer from the representative of STL member organization's signs type test report which is tested at non STL laboratory that will also be unacceptable.

7.29.6 TEST REPORT FOR ENERGY METER

Test report as per IEC shall have to be submitted from any internationally reputed independent testing laboratory.

SECTION 08

GUARANTEED TECHNICAL PARTICULAR
(GTP)
OF
(PLANT & EQUIPMENT)

8.1 GUARANTEED TECHNICAL PARTICULARS OF 33 KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected.)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
1	Manufacturer's Name & Country	-	To be mentioned	
2	Manufacturer's model no.	-	To be mentioned	
3	Maximum Rated Voltage	KV	36	
4	Frequency	Hz	50	
5	Rated Normal current	A	1600	
6	No. of phase	-	3	
7	No. of break per phase	-	To be mentioned	
8	Interrupting medium	-	Vacuum	
9	Manufacturer's name of Vacuum Interrupter (Shall be same as mentioned in Type Test Report)		To be mentioned	
10	Manufacturer's country of origin of Vacuum Interrupter		To be mentioned	
11	Manufacturer's model no. of vacuum interrupter (Same model as type test)	-	To be mentioned	
12	Class of Circuit Breaker (Through necessary test)		E2M2 or better	
13	Lightning impulse withstand to earth on 1.2/50 μ s wave	KVp	170	
14	Lightning impulse withstand across open contacts on 1.2/50 μ s wave	KVp	170	
15	Power Frequency Test Voltage (Dry), at 50Hz, 1 min to earth	KV	70	
16	Power Frequency Test Voltage (Dry), at 50Hz, 1 min across open contact	KV	70	
17	Short time withstand current, 3 second, rms	KA	31.5	

18	Breaking capacity: a) Symmetrical, rms b) Asymmetrical, rms	KA KA	31.5 To be mentioned	
19	Short circuit making current, peak	KA	80	
20	First pole to clear factor	-	1.5	
21	Rated transient recovery voltage at 100% rated short circuit breaking current	KVp	To be mentioned	
22	Rated line charging breaking current	A (rms)	10 A	
23	Rated cable charging breaking current	A (rms)	50 A	
24	Rated out of phase breaking current	A	To be mentioned	
25	Is circuit breaking restrike free?	Yes/No	Yes	
26	Trip coil current	A	To be mentioned	
27	Trip coil voltage	V, DC	110	
28	Is the circuit breaker trip free?	Yes/No	Yes	
29	Type of arc contacts or arc control Device	-	To be mentioned	
30	Main Contact:			
	a) Type of contact		To be mentioned	
	b) Material of contact surfaces		To be mentioned	
	c) Contact resistance	$\mu\Omega$	Less than 40	
31	Material of interrupter chamber	-	To be mentioned	
32	Wall thickness of interrupter chamber	-	To be mentioned	
33	Does magnetic effect of load currents increase contact pressure?	Yes/ No	To be mentioned	
34	Length of each break/ phase	mm	To be mentioned	
35	Length of stroke	mm	To be mentioned	
36	Weight of circuit breaker unit complete, without operating mechanism and structure	Kg	To be mentioned	
37	Weight of circuit breaker complete with all fittings as in service.	Kg	To be mentioned	
38	Maximum shock load imposed on floor or foundation when opening under fault conditions (state compression or tension)	N	To be mentioned	
39	Maximum pressure rise in circuit Breaker due to making or breaking of Rated current in outer chamber	KN/m ²	To be mentioned	
40	Routine pressure test on circuit Breaker tanks or chamber	KN/m ²	To be mentioned	
41	Design pressure type test on circuit Breaker tanks or chamber	KN/m ²	To be mentioned	
Operating Particulars :				

42	a) Opening time: without current at 100% of rated breaking current	ms	40 (maximum)	
	b) Breaking time	ms	100 (maximum)	
	c) Closing time	ms	To be mentioned	
	d) Closing + breaking time	ms	To be mentioned	
43	Maximum arc duration of any duty Cycle (according to IEC 62271-100)	ms At...%	To be mentioned	
44	Current at which maximum arc duration occurs (critical current)	A	To be mentioned	
45	Make time	ms	To be mentioned	
46	Minimum time for arc extinction to Contact remark when adapted for auto re-closing	ms	To be mentioned	
47	Time from closing of control switch to completion of closing stroke during fault making	ms	To be mentioned	
Constructional Features:				
48	Is an external series break Incorporated in the breaker?	Yes/ No	To be mentioned	
49	Is any device used to limit transient Recovery voltage?	Yes/ No	To be mentioned	
50	Method of closing	-	To be mentioned	
51	Method of tripping	-	To be mentioned	
52	Number of close/ trip operation possible on one spring charge	Nos.	To be mentioned	
53	Rated voltage of spring winding motor for closing	V.ac	240	
54	01 nos. spare rectifier circuit if AC motor is offered (Universal motor is preferred)		Yes	
55	Spring winding motor current	A	To be mentioned	
56	Closing release coil current	A	To be mentioned	
57	Closing release coil voltage	V.DC	110	
58	Minimum clearance in air:			
	a) Between phase	mm	370	
	b) Phase to earth	mm	325	
	c) Across circuit breaker poles	mm	To be mentioned	
	d) Live conductor to ground level	mm	To be mentioned	
	e) Live insulator to ground level	mm	To be mentioned	
59	Degree of protection	-	IP 55	
60	Material of tank or chamber	-	HCEP	
61	Material of moving contact tension rod	-	To be mentioned	
62	Period of time equipment has been in commercial operation	Year	To be mentioned	
63	No. of tripping coil	Nos.	2	
64	Circuit breaker terminal connectors	-	Copper/Al-Alloy	

65	Minimum Creepage distance (min)			
	a) To Earth	mm	To be mentioned	
	b) Across Interrupter Terminals	mm	To be mentioned	
66	Method of indicating VCB ON/ OFF	Mech.& Elect.	To be mentioned	
67	Life of interrupter	Years	To be mentioned	
68	Pressure in vacuum tube for VCB	Bar	To be mentioned	
69	Guaranteed nos. of operation for vacuum Interrupter			
	a) at rated Current switching	Nos.	To be mentioned	
	b) at Short circuit current switching	Nos.	≥ 50	
70	Rated operating sequence	-	O-0.3sec-CO-3m-CO	
71	All current carrying parts of VCB Shall be made of	-	Terminals are made by Copper/Al-Alloy and all other parts are made by copper.	
72	The VCB Shall comply all the technical specification		Yes	
73	Standard	-	IEC 62271-100	

Manufacturer's Seal & Signature

Bidder Seal & Signature

8.2 GUARANTEED TECHNICAL PARTICULARS OF 33 KV PROTECTION CONTROL AND METERING PANEL

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected.)

Sl No	Description	Unit	NESCO's Requirement	Bidders Guaranteed value
1.	Manufacturer's Name & Country of origin	-	To be mentioned	
2.	Manufacturer's Model no.	-	To be mentioned	
3.	System nominal voltage	kV	33	
4.	Maximum System Voltage	kV	36	
5.	Rated Frequency	Hz	50	
A. PROTECTION CONTROL & METERING (LINE FEEDER)				
6.	IDMT OVER CURRENT & EARTH FAULT RELAY WITH DIRECTIONAL & NON-DIRECTIONAL FEATURE			
	Manufacture's Name &		ABB-	

	Country of Origin		(Sweden/Switzerland/ Finland)/Siemens (Germany) (except 7SR series) /Alstom- (France/UK)/ Schneider- (France/UK) / SEL, USA.	
	Manufacture's Model no.		Shall be mentioned	
	Type of relay		Numerical programmable Multifunction	
	Directional Feature can be activated/de- activated	Yes/No	Yes	
	The Relay shall be IEC 61850 protocol type.		Yes	
	Range of current setting:			
	a) Phase element	% Of CT rating	Shall be mentioned	
	b) Each fault element		Shall be mentioned	
	Range of timing settings at 10-time CT rating	Sec	Shall be mentioned	
	Burden of relay at 10-time CT rating	VA	Shall be mentioned	
	Percentage of Current setting at which relay will reset	%	Shall be mentioned	
	Reset time after removal of 10-time CT rated current for: a) Phase element (100%) b) E/F element (40%)	Sec Sec	Shall be mentioned	
	Three phase power measurement option		Yes	
	Frequency Protection		Yes	
	Over voltage and under voltage		Yes	
7.	No of Binary Input (Minimum)	-	32	
	No of Binary Output (Minimum)	-	24	
	The relay shall have IEC 61850 communication Protocol Supported (Edition 2)	-	To be mentioned	
	The relay & communication port shall have IEC 61850-9-2 communication Protocol Supported		To be mentioned	
	No of Communication Ports (rear) i) Optical ii) Electrical	-	Optical 1 set (minimum)& Electrical 1 set (minimum)	
	No of Communication Ports (font) i) Electrical	-	Electrical 1 set (minimum)	
	Protection Function	-	Directional and Non Directional O/C, E/F	
	Fault locator		Must be supported	
	Sync Check function		To be supported	
	Closing circuit supervision		To be mentioned	
	Tripping circuit supervision		To be mentioned	
	Maximum time delay between initiation of fault and energize of breaker trip circuit.	-	Shall be mentioned	
	Relay Configuration Software (Name,	-	Shall be mentioned	

	Manufacturer, Version, License Requirement (with name and version))			
	Relay Configuration Software license quantity 1 (one) set		To be supplied	
	Relay configuration Probe or cable		To be supplied	
8.	Trip Circuit Supervision (TCS) Relay (Separate Relay for each trip coil)			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Type of Relay		Shall be mentioned	
	Design		Modular type	
9.	Trip Relay (Separate Relay)			
	Manufacture's Name		Shall be mentioned	
	Country of Origin		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Operating Time	Ms	<10	
	Hand and electrical type for O/C, E/F protection		Yes	
10.	Annunciator			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Windows	nos.	12	
	Built in buzzer and buttons for accept, mute, test, reset, etc.		Yes	
	Communication Protocol IEC 61850 / Modbus		Shall be mentioned	
11.	Control Switch			
	Manufacture's Name & Country		Shall be mentioned	
	Manufacture's Model/Type No.		Shall be mentioned	
	Separate discrepancy switch for circuit breaker on/off and Local Remote (L/R) selector switch		Yes	
12.	Panel Dimension (Width)	Mm	≤600	
13.	Panel Dimension (depth & Height)	mm	To be mentioned	
14.	Panel DC Power Supply system and Panel Feature			
15.	Number of 110 V DC power supply incoming to panel	Nos	2	
16.	DC Power Supply changeover		Automatic	
17.	DC Changer over time	Ms	To be mentioned	
18.	SCADA Control Option	Yes/No	Yes	
19.	CT, PT hookup option in SCADA	Yes/No	To be mentioned	
20.	Test terminal block for over current Relay	Yes/No	Yes	
21.	METERING AND INSTRUMENTATION			
34.1	MULTI TARIFF PROGRAMMABLE METER			
	Manufacture's Name & Country		Siemens (Germany/	

			Switzerland)/ AEG (Germany) / ABB (Switzerland)/ Toshiba (JAPAN) /Elster (USA /Romania), Landis+ Gyr (Switzerland/Greece)/ Honeywell (USA)/ CEWE (UK).	
	Manufacture's Model no.		Shall be mentioned	
	Type of Meter		Numerical programmable Multifunction	
	Class of Accuracy		0.2s	
34.2	MULTIFUNCTION METER. (KW, KWH, KVARH, VOLTAGE, CURRENT, PF, FREQUENCY)			
	Manufacturer's Name and Country	-	To be mentioned.	
	Manufacture's Model no.	-	To be mentioned	
	Type of meter	-	Digital	
	Class of Accuracy	-	0.5	
	Multifunction meter shall be capable of measuring & displaying MW, MVAR, PF, V, I, f, Φ etc with distinguishing import & export Operation		To be mentioned	
	Communication Protocol		IEC-61850/Modbus	
34.3	VOLT METERS with Selector Switch			
	Manufacturer's Name and Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Type of Meter		Digital	
	Class of Accuracy		1.0	
34.4	AMPERE METERS			
	Manufacturer's Name and Country		Shall be mentioned	
	Manufacture's Model no.		Shall be mentioned	
	Type of Meter		Digital	
	Class of Accuracy		1.0	
	Separate Ammeter for each phase		Yes	
	Instantaneous rated current		Shall be mentioned	
22.	The PCM Panel Shall comply all the technical specification.		Yes	

Manufacturer's Seal & Signature

Bidder Seal & Signature

8.3 GUARANTEED TECHNICAL PARTICULARS OF 110V 3X5(6)A, 3-PHASE, 4-WIRE, 3-ELEMENT, SOLID STATE INDOOR TYPE MULTI TARIFF PROGRAMMABLE METER

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	Required Specification	Manufacture's particulars
1	Reference Standard	-	Relevant ANSI / IEC	
2	Manufacturer's name & address with website, official domain email.	-	To be mentioned	
3	Meters 's type & model	-	Shall be mentioned	
4	Country of Origin	-	To be mentioned	
5	Country of Manufacture	-	To be mentioned	
6	Place of Testing	-	To be mentioned	
7	Year of Manufacture	-	To be mentioned	
8	Construction/connection	-	3-Phase 4-wire solidly grounded neutral	
9	Installation	-	Indoor installation	
10	Number of elements	-	3 (Three)	
11	Rated Voltage(P-P)	Volt	110V	
12	Minimum Biasing Voltage	Volt	40V	
13	Variation of Frequency	%	± 2%	
14	Variation of Voltage	%	+ 10, -20%	
15	Accuracy class	-	Accuracy class: 0.2s (point two S)	
16	Rated Current			
	i) Nominal Current	A	5	
	ii) Maximum Current	A	≥ 6	
17	Resister Type	-	LCD Display	
18	Number of Digits (Integer with Decimal)	Nos.	Minimum 5 (five) Integer with 3 (three) Decimal (programmable)	
19	Starting Current	mA	0.1% of Nominal Current	
20	Losses at Nominal Load	Watt & VA	Shall be mentioned	
21	Meter Constant	Imp./ KWh	Shall be mentioned	
22	Integration Period	-	30 (Thirty) Minutes	
	Resetting Period	-	1 (one) month	
	Cumulative MD transfer	-	Built in	
	Cycle Timing Device	-	Built in	
23	Size of the Digit of Display	W x H in	To be mentioned	
24	No. of Terminal	Nos.	10 (Ten) min	
25	Type of socket and country of origin	-	To be mentioned	
26	Battery Service life and shelf Life	Year	10 (ten) & 15 (fifteen)	
27	Type of Battery	-	Lithium-ion Battery	
28	Battery Country of Origin	-	To be mentioned	
29	Battery Year of manufacture	-	Not before 2023	

Sl. No.	Description	Unit	Required Specification	Manufacture's particulars
30	Clock	-	Built-in Real-Time Clock (RTC) as per IEC	
31	List of Recommended spare parts (if any)	any	Shall be mentioned	
32	Warranty	Year	3 (three)	
33	Meter Service Life (Min)	Year	15 (fifteen)	
34	Weight of meter	Kg	Shall be mentioned	
35	Dimensions	mm x mm x mm	Shall be mentioned	
36	Outlines, Drawings & Leaflets	-	Shall be mentioned	
37	Performance Curve for Balanced & Unbalanced load	-	Shall be mentioned	
38	Meter sealing condition	-	Hermetically or Ultrasonic welded (means break to open)	
39	Meter parameter Configuration	-	To be configured: both software and hardware lock	
40	Communication	-	Plug & Play 4G Communication Module	
41	Application Protocol	-	DLMS/ COSEM	
42	Bidirectional Feature	-	Different Import & Export register Applicable on Net Metering system where both way energy transfer must be registered.	
43	Memory Storage		Shall be mentioned by putting Yes/ No	
	I. Equipment Identification Code			
	II. Security code			
	III. Access code			
	IV. Number of Power Interruption with Date & Time			
	V. Latest Power Failure- Time & Date			
	VI. Event logs			
	VII. Cumulative kWh, kVarh (Q1 + Q4) Reading for previous two months			

Sl. No.	Description	Unit	Required Specification	Manufacture's particulars
	VIII. Load profile with 30 min interval at least 180 days for:			
	a) KWh, kVarh (Q1+Q4)			
	b) Phase Voltage or Vh			
	c) Phase Amps or Ah			
44	All other technical particulars which are mentioned in Technical Specification	-	Yes/ No	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.4 GUARANTEED TECHNICAL PARTICULARS OF 33KV, 1600A OFF-LOAD ISOLATOR WITH EARTH BLADE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
General Description of Disconnecting Switch				
1.	Manufacturer's Name and country	-	To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Frequency	Hz	50	
4.	System Nominal Voltage	kV	33	
5.	System Maximum Voltage	kV	36	
6.	Basic Insulation Level	kV	170	
7.	Rated Normal Current	A	1600	
8.	Lightning impulse withstand to earth (waveshape: 1.2/50µs)	KV-pk	170	
9.	Lightning impulse withstand across open contacts (waveshape: 1.2/50µs)	KV-pk	170	
10.	Power Frequency Withstand Voltage (for 1 min) to earth	kV	70	
11.	Power Frequency Withstand Voltage (for 1 min) across open contacts.	kV	70	
12.	Rated short time withstand current (for 3sec.)	kA	31.5	
13.	Installation	-	Outdoor	
14.	Type	-	Single Horizontal/Vertical Break	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
15.	Construction	-	Open	
16.	Mounting Position	-	Horizontal	
17.	Number of Pole	nos.	3 (Three)	
18.	No. of break per pole	nos.	One	
19.	Air gap between pole of phase	mm	1000	
20.	Insulator Material	-	Porcelain	
21.	Creepage distance of Insulator (Consider Maximum Rated Voltage)	mm/K V	25	
22.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
23.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
Contacts:				
24.	Materials of the current carrying path		Copper with Nickel Plating	
25.	Contact Resistance for DS & ES	$\mu\Omega$	Less than 50	
26.	Contact Area:			
27.	Moving Blade for DS	mm ²	6x75 mm copper flat bar, length 750±20 mm -02 Nos per phase	
28.	Moving Blade for ES		6x50 mm copper flat bar, length 500±15 mm -02 Nos per phase	
29.	Terminal Pad	mm ²	12x76 mm Copper flat bar -02 Nos per phase	
30.	Contact type		Spring loaded contact	
31.	Operation	-	Gang	
32.	Type of main DS operating mechanism	-	Manual	
33.	Number of main DS operating mechanism per set	Nos	1	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
34.	Type of Earth Switch operating mechanism	-	Manual	
35.	Number of Earth Switch operating mechanism per set	Nos	1	
36.	Nos. of Auxiliary Contracts (NO/NC) For Isolator & Earth Switch	-	Isolator- 4NO-4NC Earth switch – 4NO-4NC	
37.	Locking facility in the operating box in both close and open position	-	Yes	
38.	Mechanical Interlocking facility between main DS and ES	-	Yes	
39.	Operating GI Pipe Dimensions:	-		
40.	For main DS	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	
41.	For Earth Switch (DS and Earth switch pipe will be separate)	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	
42.	Controlling handle. Length of Isolator operating Pipe <i>(Attached, no separate pipe, must have the provision for using both hands simultaneously, T Shaped)</i>		≥400mm	
43.	Electrical control of Operation with interlock		To be mentioned	
44.	MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized)			
45.	For main DS	-	32x32x3600 mm	
46.	For Earth Switch	-	25x25x3600mm	
47.	Total weight of Isolator	Kg	To be mentioned	
48.	Total weight of earth switch	Kg	To be mentioned	
49.	Total weight of Unit	Kg	To be mentioned	
50.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be mentioned	
51.	Manufacturer's Printed Catalogue			

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
	describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	
52.	Standard		IEC-62271-102	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.5 GUARANTEED TECHNICAL PARTICULARS OF 33 KV, 1600A OFF-LOAD ISOLATOR WITHOUT EARTH BLADE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
General Description of Disconnecting Switch				
1.	Manufacturer's Name and country	-	To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Frequency	Hz	50	
4.	System Nominal Voltage	kV	33	
5.	System Maximum Voltage	kV	36	
6.	Basic Insulation Level	kV	170	
7.	Rated Normal Current	A	1600	
8.	Lightning impulse withstand to earth (waveshape: 1.2/50µs)	KV-pk	170	
9.	Lightning impulse withstand across open contacts (waveshape: 1.2/50µs)	KV-pk	170	
10.	Power Frequency Withstand Voltage (for 1 min) to earth	kV	70	
11.	Power Frequency Withstand Voltage (for 1 min) across open contacts.	kV	70	
12.	Rated short time withstand current (for 3sec.)	kA	31.5	
13.	Installation	-	Outdoor	
14.	Type	-	Single Vertical Break	
15.	Construction	-	Open	
16.	Mounting Position	-	Vertical	
17.	Number of Pole	nos.	3 (Three)	
18.	No. of break per pole	nos.	One	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
19.	Air gap between pole of phase	mm	1000	
20.	Insulator Material	-	Porcelain	
21.	Creepage distance of Insulator	mm	To be mentioned	
22.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
23.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)		To be mentioned	
24.	Materials of the current carrying path		Copper with Nickel Plating	
25.	Contract Resistance	$\mu\Omega$	Less than 50 $\mu\Omega$	
26.	Contact Area:			
27.	Moving Blade	mm ²	6x75 mm copper flat bar, length 750 $\pm$ 20 mm -02 Nos per phase	
28.	Terminal Pad	mm ²	12x76 mm Copper flat bar -02 Nos per phase	
29.	Contact type		Spring loaded contact	
30.	Operation	-	Gang	
31.	Type of main DS operating mechanism	-	Manual	
32.	Number of main DS operating mechanism per set	Nos	1	
33.	Nos. of Auxiliary Contracts (NO/NC) For Isolator	-	Isolator- 4NO-4NC	
34.	Locking facility in the operating box in both and open position	-	Yes	
35.	Operating GI Pipe Dimensions:	-		
36.	For main DS	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	
37.	For Earth Switch (DS and Earth switch pipe will be separate)	-	OD- 42 mm, ID – 36 mm, Length – 6 meter	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
38.	Controlling handle. length of Isolator operating Pipe (Attached, no separate pipe, must have the provision for using both hands simultaneously, T Shaped)		≥400mm	
39.	MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized):	-		
40.	For main DS	-	32x32x3600 mm	
41.	Total weight of Isolator	Kg	To be mentioned	
42.	Total weight of Unit	Kg	To be mentioned	
43.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be mentioned	
44.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be mentioned	
45.	Standard		IEC-62271-102	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.6 GUARANTEED TECHNICAL PARTICULARS OF 33 KV OFF-LOAD ISOLATOR WITHOUT EARTH BLADE BUS SECTIONALIZER

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

SL No	Description	Unit	NESCO's Requirement	Manufacturer's Particulars
General Description of Disconnecting Switch				
1	Manufacturer's Name and country	-	To be mentioned	
2	Application of the Disconnecting Switch		For BUS Sectionalizer	
3	Manufacturer's Model No.	-	To be mentioned	
4	Frequency	Hz	50	
5	System Nominal Voltage	kV	33	
6	System Maximum Voltage	kV	36	
7	Basic Insulation Level	kV	170	

SL No	Description	Unit	NESCO's Requirement	Manufacturer's Particulars
8	Rated Normal Current	A	2500	
9	Lightning impulse withstand to earth (waveshape: 1.2/50 μ s)	KV-pk	170	
10	Lightning impulse withstand across open contacts (waveshape: 1.2/50 μ s)	KV-pk	170	
11	Power Frequency Withstand Voltage (for 1 min) to earth	kV	70	
12	Power Frequency Withstand Voltage (for 1 min) across open contacts.	kV	70	
13	Rated short time withstand current (for 3sec.)	kA	31.5	
14	Installation	-	Outdoor	
15	Type	-	Single Horizontal Break	
16	Construction	-	Open	
17	Mounting Position	-	Horizontal	
18	Number of Pole	nos.	3 (Three)	
19	No. of break per pole	nos.	One	
20	Air gap between pole of phase	mm	1000	
21	Insulator Material	-	Porcelain	
22	Creepage distance of Insulator	mm/KV	25 (Minimum)	
23	Current density at the minimum cross Section of			
	a) Moving Blade	Amps/Sq.mm	To be mentioned	
	b) Terminal Pad	Amps/Sq.mm	To be mentioned	
	c) Contacts	Amps/Sq.mm	To be mentioned	
	d) Terminal Connector	Amps/Sq.mm	To be mentioned	
24	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)	deg. C	To be mentioned	
25	Materials of the current carrying path		Copper with Nickel Plating	

SL No	Description	Unit	NESCO's Requirement	Manufacturer's Particulars
26	Contact Resistance		Less than 40 $\mu\Omega$	
27	Contact Area			
	Moving Blade	mm ²	8x80 mm copper flat bar, length 750 $\pm$ 20 mm - 02 Nos per phase	
	Terminal Pad	mm ²	14x90 mm copper flat bar	
28	Contact type		Spring loaded contact	
Operating Mechanism				
29	Operation	-	Gang	
30	Type of main DS operating mechanism	-	Manual	
31	Number of main DS operating mechanism per set	Nos	1	
32	Nos. of Auxiliary Contacts (NO/NC) For Isolator	-	Isolator- 4NO-4NC	
33	Locking facility in the operating box in both and open position		Yes	
34	Electrical operation with interlock		To be mentioned	
35	Operating GI Pipe Dimensions			
	For main DS		OD- 42 mm, ID –36 mm, Length – 6 meter	
	Controlling handle (Attached, no separate pipe) length of Isolator operating Pipe.		≥ 400 mm	
36	No separate pipe can be used. Must have the provision for using both hands simultaneously, T Shaped		Yes/No	
37	MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized)			
38	For main DS		32x32x3600 mm	
39	Total weight of Isolator	Kg	To be mentioned	
40	Total weight of Unit	Kg	To be mentioned	
41	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting	-	To be provided	

SL No	Description	Unit	NESCO's Requirement	Manufacturer's Particulars
	Structure Arrangement			
42	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be provided	
43	Standard		IEC-62271-102	
**** All exposed MS parts should be Hot Dip Galvanized****				

Seal & Signature of the Bidder

Seal & Signature of the Manufacturer

8.7 GUARANTEED TECHNICAL PARTICULARS OF 33 KV, 400A OFF-LOAD FUSED ISOLATOR FOR BUS PT

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
General Description of Disconnecting Switch				
1.	Manufacturer's Name and country	-	To be mentioned	
2.	Manufacturer's Model	-	To be mentioned	
3.	Application of the Disconnecting Switch		For PT & Auxiliary Transformer	
4.	Frequency	Hz	50	
5.	System Nominal Voltage	kV	33	
6.	System Maximum Voltage	kV	36	
7.	Basic Insulation Level	kV	170	
8.	Rated Normal Current	A	400	
9.	Lightning impulse withstand to earth (waveshape: 1.2/50µs)	KV-pk	170	
10.	Lightning impulse withstand across open contacts (waveshape: 1.2/50µs)	KV-pk	170	
11.	Power Frequency Withstand Voltage (for 1 min) to earth	kV	70	
12.	Power Frequency Withstand Voltage (for 1 min) across open contacts.	kV	70	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
13.	Rated short time withstand current (for 3sec.)	kA	31.5	
14.	Installation	-	Outdoor	
15.	Type	-	Single Vertical Break Offload Fused Isolator	
16.	Construction	-	Open	
17.	Mounting Position	-	Vertical	
18.	Number of Pole	nos.	3 (Three)	
19.	No. of break per pole	nos.	One	
20.	Air gap between pole of phase	mm	1000	
21.	Insulator Material	-	Porcelain	
22.	Creepage distance of Insulator	mm	To be mentioned	
23.	Current density at the minimum cross Section of a) Moving Blade b) Terminal Pad c) Contacts d) Terminal Connector	Amps/ Sq.mm	To be mentioned	
24.	Maximum Temp. rise of current carrying parts when carrying rated current continuously (deg. C)	deg. C	To be mentioned	
Contacts:				
25.	Materials of the current carrying path		Copper with Nickel Plating	
26.	Contact Area:			
24.1	Moving Blade	mm ²	5x30 mm copper flat bar, length 810±20 mm -02 Nos per phase	
24.2	Terminal Pad	mm ²	6x40 mm Copper flat bar -02 Nos per phase	
27.	Contact type		Spring loaded contact	
28.	Operation	-	Gang	
29.	Type of main DS operating mechanism	-	Manual	
30.	Number of main DS operating mechanism per set	Nos	1	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
31.	Nos. of Auxiliary Contracts (NO/NC) For Isolator	-	Isolator- 4NO-4NC	
32.	Locking facility in the operating box in both and open position		Yes	
33.	Operating GI Pipe Dimensions			
31.1	For main DS		OD- 42 mm, ID – 36 mm, Length – 6 meter	
31.2	Controlling handle length of Isolator operating Pipe (Attached, no separate pipe, must have the provision for using both hands simultaneously, T Shaped)		≥400mm	
	Electrical control of Operation		To be mentioned	
34.	MS Solid Square Shaft Dimensions for gang operation (Hot Dip Galvanized):			
	For main DS		32x32x3600 mm	
35.	Total weight of Unit	Kg	To be mentioned	
36.	Rated Fuse Voltage	kV	33	
37.	Fuse type	-	Drop Out Fuse Barrel with Link	
38.	Rated fuse link normal current	A		
	a) For 33 KV Bus PT		1-2 Amperes	
39.	Rated fuse link interrupting current	kA	31.5 kA, RMS Symmetrical	
40.	Fuse link type	-	Two element, slow/fast unit	
41.	Fuse end cap type	-	Heavy duty, sealed cap with weather seal at both ends	
42.	Fuse link co-ordination	-	Shall co-ordinate with existing system protective equipment	
43.	Outline Dimensional & Cross-section Drawings of Offered type 33KV Isolator & Mounting Structure Arrangement	-	To be provided	
44.	Manufacturer's Printed Catalogue describing Specification & Technical Data of Offered type Equipment.	-	To be provided	
45.	Standard		IEC-62271-102	

Note: All exposed MS parts should be Hot Dip Galvanized

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.8 GUARANTEED TECHNICAL PARTICULARS OF 33 KV 600-1200/5-5-5A OUTDOOR TYPE SINGLE PHASE CURRENT TRANSFORMER

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected.)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
1	Manufacturer's name & country	-	To be mentioned	
2	Country of Origin and country of Manufacture	-	To be mentioned	
3	Manufacturer's model no.	-	To be mentioned	
4	Country of Origin	-	To be mentioned	
5	Application	-	Metering & Protection	
6	Type	-	Induction	
7	Installation	-	Outdoor	
8	Construction	-	Sealed Tank	
9	Insulation	-	Oil	
10	Number of Phase	-	Single	
11	Rated Frequency	Hz	50	
12	Mounting	-	On Supporting Structure	
13	Primary Rated Voltage (Phase to Phase)	kV	33	
14	Maximum System Voltage (Phase to Phase)	kV	36	
15	System Earthing	-	Effectively earthed	
16	Basic Insulation Level (1.2/50 Micro-sec.)	kV	≥ 170	
17	Power Frequency Withstand Voltage (1 Min. 50 Hz) at Primary (Dry)	kV	≥ 70	
	Power Frequency Withstand Voltage (1 Min. 50 Hz) at Primary (Wet)	kV	≥ 70	
18	Power Frequency Withstand Voltage (1 Min. 50 Hz) at Secondary.	kV	≥ 3	
19	Partial Discharge at Voltage U_m	pC	≤ 10	
	Partial Discharge at Voltage $1.2 U_m/\sqrt{3}$	pC	≤ 5	
20	Inter Turn Insulation Withstand Voltage	KVP	To be mentioned	
21	CT Ratio:			
	600-1200/5-5-5	-	600-1200/5-5-5	
22	Type of Winding:			

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
	a) Primary	-	Single Winding	
	b) Secondary	-	Triple Winding (2 measuring, 1 protection)	
23.1	Cross sectional area of primary Terminal (<i>No Threading is allowed in primary terminal</i>)	mm ²	To be mentioned	
23.2	Core Cross Sectional Area	mm ²	To be mentioned	
23.3	Core Material & Model	-	To be mentioned	
23.4	Winding Material and Cross-Sectional Area (Primary & Secondary)	-	To be mentioned	
23.5	Number of Turn (Primary & Secondary)	Nos	To be mentioned	
24	Accuracy Class:			
	a) for Measurement	-	0.2S	
	b) for Protection	-	5P30	
25	Burden:			
	a) for Measurement Core	VA	30	
	b) for Protection Core	VA	30	
26	RCT at 75 °C at:			
	a) for Measurement core			
	a) 1200/5	mΩ	To be mentioned (it should be consistent with type tested unit)	
	b) 600/5	mΩ	To be mentioned (it should be consistent with type tested unit)	
	a) for Protection Core			
	a) 1200/5	mΩ	To be mentioned (it should be consistent with type tested unit)	
	b) 600/5	mΩ	To be mentioned (it should be consistent with type tested unit)	
27	Knee-point Voltage:			
	a) for Measurement core			
	a) 1200/5	V	To be mentioned (Supported by details calculation)	
	b) 600/5	V	To be mentioned (Supported by	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
			details calculation)	
	a) for Protection Core			
	a) 1200/5	V	To be mentioned (Supported by details calculation)	
	b) 600/5	V	To be mentioned (Supported by details calculation)	
28	Short Time Thermal Current Rating, for 1 sec, ISC	kA	31.5	
29	Short Time Dynamic Current Rating IDyn	kA	78.75	
30	Extended Current Rating (% of rated current)	%	120	
31	Rated Continuous Thermal Current	%	100	
32	Over Current Rating	A	<10	
	Limit of temperature rises above 40°C ambient temperature for continuous operation at rated continuous thermal current.			
	a) Winding	-	To be mentioned	
	b) Top Oil	-		
	c) Connection, bolted or the equivalent (No Threading Is allowed at CT Primary Terminal Contacts.)	-		
34	Instrument Safety Factor	Times	<5	
35	Rated Accuracy Limit Factor (ALF)	-	≥ 30	
	For Measurement Core:			
	Maximum Errors at 1% Rated Primary Current			
	Ratio Error (maximum)	%	To be mentioned	
	Phase Displacement	Minutes	To be mentioned	
	For Protection Core:			
	Maximum Errors at Rated Primary Current			
	Ratio Error (maximum)	%	To be mentioned	
	Phase Displacement	Minutes	To be mentioned	
37	Creepage Distance at Maximum System Voltage (min ^m)	mm/kV	≥ 25	
38	33 KV CT Terminal Block must be Standard CT Terminal Block Type of minimum 10 mm ² and it will be capable of holding two 6 mm ² cable in one terminal. Ct secondary terminal block wire connection must be "O" lug supported.	-	Yes/No	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
39	The CT Secondary Cable Must Take to PCM Panel Through Marshalling Box. All Secondary Core Cable Need to Take Through CT Marshalling Box.	-	Yes	
40	All the Control Cable for Connection from CT Secondary Side to Marshalling Box and From Marshalling Box to PCM Panel will be of 4 mm ² (minimum) size. All the CT Secondary Cable will go through marshaling box.	-	Yes	
41	Outline of Overall Dimension, Cross-section Drawings of offered CT, Electrical clearance to earth, Detail Drawings of Insulators mentioning creepage distance, Drawing of parts of the Main Circuit and associated Components (Details of Primary, Secondary winding, Core Dimension & Curve, Lamination, Detail of Terminals & mounting structure	-	To be submitted	
42	Printed catalogue describing specification and technical data of the offered type CT	-	To be submitted	
43	Test Report of Temperature Rise Test, Impulse Voltage Withstand Test, All Tests of Accuracy (Ratio & Phase Displacement), Short Time Current Test, Wet Test (For Outdoor Instruments), Power Frequency Voltage Withstand Test for Primary & Secondary, Inter Turn Overvoltage Test, Instrument Security Factor Test.	-	To be submitted	
44	Standard	-	As per relevant IEC 61869-1, IEC 61869-2	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.9 GUARANTEED TECHNICAL PARTICULARS OF 33 KV OUTDOOR TYPE SINGLE PHASE POTENTIAL TRANSFORMER

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected.)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's Guaranteed Particulars
1	Manufacturer's Name & Country or origin	-	To be mentioned	
2	Manufacturer's Model No.	-	To be mentioned	
3	Type	-	Induction Type	
4	Rated Primary Voltage	KV	36	
5	Ratio	V	$33000/\sqrt{3}:110/\sqrt{3}:110/\sqrt{3}$	
6	No. of phase	Nos.	Single Phase	
7	Type of Insulation	-	To be mentioned	
8	Total capacitance at 100 Hz	PF	To be mentioned	
9	Power frequency withstand voltage (Dry)	KV	70	
	Power frequency withstand voltage (wet)	KV	70	
10	Impulse withstands (1.2/50 micro sec. wave) at dry	KV	170	
11	Short circuit withstand capability	KA	To be mentioned	
12	Rated burden per phase	VA	50VA	
13	Class of accuracy	-	0.2+3P	
14	Temperature co-efficient of ratio per °C	-	To be mentioned	
15	System earthing	-	Effectively Earthed	
16	Partial discharge magnitude	pC	10	
17	Creepage Distance	mm/kV	25 (min)	
18	Maximum errors with 5% primary voltage:			
	a) Ratio	%	To be mentioned	
	b) Phase angle	minutes	To be mentioned	
19	Total weight complete	Kg	To be mentioned	
20	Standard	-	As per relevant IEC 61869-1, IEC 61869-3	

Seal & Signature
of the Manufacturer

Seal & Signature
of the Bidder

8.10 GUARANTEED TECHNICAL PARTICULARS OF 33KV SINGLE PHASE LIGHTNING ARRESTER

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Particulars
1.	Reference Standard		IEC 60099-4	
2.	Name and address of Manufacturer	-	To be mentioned	

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Particulars
3.	Country of origin		To be mentioned.	
4.	Place of manufacture		To be mentioned.	
5.	Manufacturer's model No.	-	To be mentioned	
6.	Class of diverter as per IEC 60099-4 (latest version)		Heavy duty, ZnO	
7.	Type of the Arrester	-	Metal Oxide (ZnO), Gapless-Outdoor (Single Unit)	
8.	Rated Arrester Voltage	kV	36	
9.	Continuous Operating Voltage (COV, Uc)	kV	22- 27.5	
10.	Nominal Discharge Current (8/20micro sec)	KA	10	
11.	Material of housing	-	Polymer (Hydrophobic silicon)	
12.	Manufacturer and address of ZnO Block	-	To be mentioned	
13.	Power Frequency withstand voltage of the Arrester Housing, Dry & Wet for 1 minute	kV rms	70 (Dry & Wet)	
14.	Impulse withstand Voltage of the Arrester Housing.	kV (peak)	170	
15.	Lightning Impulse Residual Voltage (8/20 micro-second wave)	kV (peak)	100 or better	
16.	Steep Current Impulse Residual Voltage at 10 KA of 1 micro second front time.	kV (peak)	110 or better	
17.	High Current Impulse Withstand Value (4/10 micro second)	KA	100 or better	
18.	Temporary Over voltage capability:			
	a) 0.1 Second	kV (peak)	Shall be mentioned	
	b) 1.0 Second	kV (peak)	Shall be mentioned	
	c) 10 Second	kV (peak)	Shall be mentioned	
	d) 100 Second	kV (peak)	Shall be mentioned	
19.	Leakage Current at rated voltage	mA	≤ 1 mA	
20.	Total Creepage distance (minimum)	mm/ kV	31	
21.	Overall dimension:			
	a) Height	mm	Shall be mentioned	
	b) Diameter	mm	Shall be mentioned	
22.	Total weight of Arrester	Kg.	Shall be mentioned	
23.	Line discharge class	-	Shall be mentioned	

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Particulars
24.	Partial Discharge (pico-coulomb) when energized at 1.05 times its continuous operating voltage.	Not exceeding 10 pC	Not exceeding 10 pC	
25.	Short Circuit Current Withstand duration	Sec	31.5 kA, 1 sec	
26.	Minimum Energy Discharge capability (KJ/KV) at rated voltage	-	5	
27.	Min. Bending load (kgm)		To be mentioned	
28.	Surge Counter /Monitor		Shall be provided	
29.	Surge monitor shall be insulated		YES	
30.	Cable for Connecting Surge Counter		Shall be provided	
31.	Connecting Lead from LA terminal to surge monitor		Insulated copper cable of minimum 95mm ² size	

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8.11 GUARANTEED TECHNICAL PARTICULARS OF TERMINATION KITS (OUTDOOR) FOR 33 KV XLPE 1CX500 MM² CABLE

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	NESCO's Requirement	Manufacturer's Particulars
1.	Name of the Item	Termination kits (Outdoor Type) for 1×500 mm ² XLPE Insulated Copper Cable	
2.	Country of origin	UK /USA/EU/Japan/Canada/ Australia/ Switzerland.	
3.	Country of Manufacture	UK /USA/EU/Japan/Canada/ Australia/ Switzerland.	
4.	Manufacturer's name & Address	Shall be mentioned	
5.	Manufacturer's Model No.	Shall be mentioned	
6.	Standard	Performance Design and Testing shall be in accordance with the BS, IEC, VDE or equivalent international standards. (Standard Name Must Be Mentioned & Successful Tenderer Must Provide Original Copy of Relevant Standard Immediately After Contract).	
7.	Application	For 33KV 1X500 mm ² XLPE Insulated Copper Cable	
8.	Installation	Outdoor, to be installed on Poles/Structure	

Sl. No.	Description	NESCO's Requirement	Manufacturer's Particulars
9.	Construction	The outdoor termination shall be proof against ingress of moisture and water.	
10.	Nominal System Voltage	33 KV (Phase to Phase)	
11.	Maximum System Voltage	36 KV (Phase to Phase)	
12.	Impulse Withstand Voltage (Minimum)	170 kV	
13.	Power Frequency Withstand Voltage (Minimum)	81 kV for 5 minutes	
14.	Number of Core	1	
15.	Size of the Conductor	500 mm ²	
16.	Type of Insulation	XLPE	
17.	Type of Screening	Copper wire and Copper Tape	
18.	Type of Cable Box	Air Filled	
19.	System Neutral Earthing	Effectively earthed	
20.	Kit Component Note1: <i>Material, Dimension and Quantity must be mentioned</i> Note2: (Not limited to these). If there are alternatives of the mentioned kit components or additional kit components available in manufacturer's proposed solution, then name of the alternatives and additional components shall be mentioned in sl. no. 21 & 22 respectively)	a) Stress Control Tube b) Non-Tracking Weather Resistance Tube c) Lug Sealing Tube d) Creep age Extension Shed e) Non-Tracking Sealing Mastic Tape f) Black Mastic Tape g) Stress Grading Mastic h) Silicone Grease i) S.S Hose Clip j) Tinned Copper Wire Mesh k) Tinned copper Braid l) Al. Oxide Cloth 150 Mesh m) Al. Oxide Cloth 240 Mesh n) Compression Copper Lug o) Compression Copper Lug for Screen Wires p) Cleaning Solvent Ampules q) Cleaning Cloth r) PVC Tape s) Polythene Tape t) Detailed instruction manual. u) Packing Slip/list	
21.	Alternatives of the kit components mentioned in sl. no. 20 as per manufacturer's solution (if any)	To be mentioned	
22.	Additional kit components in excess of the components mentioned in sl. no. 20 as per manufacturer's solution (if any)	To be mentioned	
23.	Core Length of Termination	To be mentioned	
24.	Dimensions of the Item	Drawing shall be provided and details dimension will be mentioned.	
25.	Minimum Performance Data for AC Voltage Withstand, Impulse Voltage Withstand and DC Voltage	To be mentioned (with reference standard)	

Sl. No.	Description	NESCO's Requirement	Manufacturer's Particulars
	Withstand		

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8.12 GUARANTEED TECHNICAL PARTICULARS FOR SINGLE-CORE, 150 MM² HARD DRAWN BARE COPPER CONDUCTOR FOR GROUNDING SYSTEM.

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		1CX150 sq. mm Hard Drawn bare copper stranded conductor	
2	Name of the Manufacturer		Shall be mentioned	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		To be mentioned	
5	Cable Size	mm ²	1CX150	
6	Material		High Conductive Copper	
7	Numbers & Diameter of wires	mm	Min 37 Wires/2.35 (Before stranding)	
8	Wire Diameter Tolerance	mm	±0.05	
9	Maximum DC resistance at 20 deg. C	Ω/K M	0.1233	
10	Approximate outer diameter (Nominal)	mm	14.44 to 15.4	
11	Approximate weight	Kg/K M	1335	
12	Continuous permissible service voltage	V	600/1000	
13	Volume Resistivity of Copper Conductor at 20°C	Ω-mm ² /m	To be Mentioned with name of related standard	
14	Conductivity of Copper Conductor at 20°C	% (IACS)	97 (Min.m)	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	Shall be mentioned	
16	Current rating at 35 deg. C ambient in air	Amps	Shall be mentioned	
17	Drum wound length	M	500/1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Minimum Breaking Load	N	Shall be mentioned	
21	Lay Ratio of Different Layer	-	Shall be mentioned	
22	Treated Wooden Drum Standard		Shall be mentioned the name of used latest	

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
			international standards	

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Seal & signature of Manufacturer

8.13 GUARANTEED TECHNICAL PARTICULARS FOR SINGLE-CORE, 150 MM² PVC INSULATED AND PVC SHEATHED COPPER CABLE FOR GROUNDING SYSTEM.

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		1CX150 sq. mm PVC Insulated and PVC Sheathed Cables	
2	Name of the Manufacturer		Shall be mentioned	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	1CX150	
6	Material		PVC Insulated and PVC Sheathed plain annealed copper.	
7	Numbers & Diameter of wires	mm	Min 37 Wires/To Be Mentioned	
8	Maximum DC resistance at 20 deg. C	Ω/KM	0.124	
9	Nominal thickness of insulation	m	1.8	
10	Nominal thickness of sheath	mm	1.8	
11	Color of sheath		Black	
12	Approximate outer diameter	mm	23.1	
13	Approximate weight	Kg/K M	1709	
14	Continuous permissible service voltage	V	600/1000	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	350	
16	Current rating at 35 deg. C ambient in air	Amps	405	
17	Drum wound length	M	500	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard		To be mentioned the name of used latest International standards	

Seal and Signature

Seal and Signature





of the manufacturer:

of the Bidder:

8.14 GUARANTEED TECHNICAL PARTICULARS FOR SINGLE-CORE, 70 MM² PVC INSULATED AND PVC SHEATHED COPPER CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		1CX70 sq. mm PVC Insulated and PVC Sheathed Cables	
2	Name of the Manufacturer		Shall be mentioned	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent international standards.	
5	Cable Size	mm ²	1CX70	
6	Material		PVC Insulated and PVC Sheathed plain annealed copper.	
7	Numbers & Diameter of wires	mm	19/2.17	
8	Maximum resistance at 20 deg. C	Ω/KM	0.268	
9	Nominal thickness of insulation	mm	1.4	
10	Nominal thickness of sheath	mm	1.8	
11	Colour of sheath		Black	
12	Outer diameter (min)	mm	17.3	
13	Approximate weight	Kg/K M	858	
14	Continuous permissible service voltage	V	600/1000	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	225	
16	Current rating at 35 deg. C ambient in air	Amps	245	
17	Drum wound length	M	500	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard		To be mentioned the name of used latest International standards	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.15 GUARANTEED TECHNICAL PARTICULARS FOR SINGLE-CORE, 95 MM² PVC INSULATED AND PVC SHEATHED COPPER CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		1CX95 sq. mm PVC Insulated and PVC Sheathed Cables	
2	Name of the Manufacturer		Shall be mentioned	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent international standards.	
5	Cable Size	mm ²	1CX95	
6	Material		PVC Insulated and PVC Sheathed plain annealed copper.	
7	Numbers & Diameter of wires	mm	19/2.52	
8	Maximum resistance at 20 deg. C	Ω/KM	0.193	
9	Nominal thickness of insulation	mm	1.6	
10	Nominal thickness of sheath	mm	1.8	
11	Colour of sheath		Black	
12	Outer diameter (min)	mm	19.4	
13	Approximate weight	Kg/KM	1129	
14	Continuous permissible service voltage	V	600/1000	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	270	
16	Current rating at 35 deg. C ambient in air	Amps	300	
17	Drum wound length	M	500	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard		To be mentioned the name of used latest International standards	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.16 GUARANTEED TECHNICAL PARTICULARS FOR SINGLE-CORE, 120 MM² PVC INSULATED AND PVC SHEATHED COPPER CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item		1CX120 sq. mm PVC Insulated and PVC Sheathed Cables	

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
2	Name of the Manufacturer		Shall be mentioned	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	1CX120	
6	Material		PVC Insulated and PVC Sheathed plain annealed copper.	
7	Numbers & Diameter of wires	mm	37/2.03	
8	Maximum resistance at 20 deg. C	Ω/KM	0.153	
9	Nominal thickness of insulation	mm	1.6	
10	Nominal thickness of sheath	mm	1.8	
11	Colour of sheath		Black	
12	Outer diameter (min)	mm	21	
13	Approximate weight	Kg/K M	1384	
14	Continuous permissible service voltage	V	600/1000	
15	Current rating at 30 deg. C ambient temperature U/G	Amps	310	
16	Current rating at 35 deg. C ambient in air	Amps	350	
17	Drum wound length	M	500	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard		To be mentioned the name of used latest International standards	

Seal and Signature
of the manufacturer:

Seal and Signature
of the Bidder:

8.17 GUARANTEED TECHNICAL PARTICULARS FOR 2CX2.5 MM2 PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	2CX2.5 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent international standards.	
5	Cable Size	mm ²	2CX2.5 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	0.8 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	.2 mm (min). But in case of aluminum or aluminum alloy it should be .5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D + 1.0 (min) Calculation to be submitted.	
14	Color of sheath		Black	
15	Filler material, Inner Sheath material			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core	-	Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/K M	Shall be mentioned	
19	Drum wound length	M	1000	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest international standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.18 GUARANTEED TECHNICAL PARTICULARS FOR 4CX2.5 MM2 PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	4CX2.5 mm ² PVC	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
			Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	4CX2.5 mm ²	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	0.8 (min.) But if fictitious diameter under the armour is more than 9mm then diameter of steel wire should be 1.25 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D+1.0 (min) Calculation to be submitted.	
14	Color of sheath		Black	
15	Filler material, Inner Sheath material,			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core		Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/KM	Shall be mentioned	
19	Drum wound length	M	1000	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.19 GUARANTEED TECHNICAL PARTICULARS FOR 8CX2.5 MM² PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item		8CX2.5 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer		Shall be mentioned	
3	Address of the Manufacturer		Shall be mentioned	
4	Standard		Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	8CX2.5 mm ²	
6	Material		Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	1.25 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D + 1.0 (min) Calculation to be submitted.	
14	Color of sheath		Black	
15	Filler material, Inner Sheath material,			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core		Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/KM	Shall be mentioned	
19	Drum wound length	M	1000	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.20 GUARANTEED TECHNICAL PARTICULARS FOR 14CX2.5 MM² PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	14CX2.5 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	14CX2.5 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	1.25 (min.) But if fictitious diameter under the armor is more than 14mm then diameter of steel wire should be 1.6 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D+1.0 (min) Calculation to be submitted.	
14	Color of sheath		Black	
Filler material, Inner Sheath material,				
15	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core	-	Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/KM	Shall be mentioned	
19	Drum wound length	M	1000 or 500. 1000-meter preferable if can be handled safely.	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
22	Treated Wooden Drum Standard		To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.21 GUARANTEED TECHNICAL PARTICULARS FOR 16CX2.5 MM2 PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	16CX2.5 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	16CX2.5 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	1.6 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D+1.0 (min) Calculation to be submitted.	
14	Color of sheath		Black	
Filler material, Inner Sheath material,				
15	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core		Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
18	Approximate weight	Kg/K M	Shall be mentioned	
19	Drum wound length	M	1000 or 500. 1000-meter preferable if can be handled safely.	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard		To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.22 GUARANTEED TECHNICAL PARTICULARS FOR 19CX2.5 MM2 PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	19CX2.5 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	19CX2.5 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	1.6 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	T _s =.035*D+1.0 (min)	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
			Calculation to be submitted.	
14	Color of sheath		Black	
15	Filler material, Inner Sheath material			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core		Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/K M	Shall be mentioned	
19	Drum wound length	M	1000 or 500. 1000-meter preferable if can be handled safely.	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.23 GUARANTEED TECHNICAL PARTICULARS FOR 24CX2.5 MM² PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	24CX2.5 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	24CX2.5 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.67	
8	Diameter of Steel wires	mm	1.6 (min.) But if fictitious diameter under the armor is more than 24mm then	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
			diameter of steel wire should be 2 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But if fictitious diameter under the armor is more than 29mm then thickness of steel tape should be 0.5 (min.) But in case of aluminum or aluminum alloy it should be .5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	7.41	
12	Nominal thickness of insulation	mm	0.8 (min.)	
13	Nominal thickness of sheath	mm	$T_s = .035 * D + 1.0$ (min) Calculation to be submitted.	
14	Color of sheath		Black	
15	Filler material, Inner Sheath material,			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core		Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/K M	Shall be mentioned	
19	Drum wound length	M	1000 or 500. 1000-meter preferable if can be handled safely.	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.24 GUARANTEED TECHNICAL PARTICULARS FOR 2CX4.0 MM² PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	2CX4 mm ² PVC Insulated	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
			and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	2CX4 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.85	
8	Diameter of Steel wires	mm	0.8 (min.) But if fictitious diameter under the armor is more than 9mm then diameter of steel wire should be 1.25 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	4.61	
12	Nominal thickness of insulation	mm	1 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D+1.0 (min) Calculation to be submitted.	
14	Color of sheath	-	Black	
15	Filler material, Inner Sheath material,			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core	-	Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/KM	Shall be mentioned	
19	Drum wound length	M	1000	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.25 GUARANTEED TECHNICAL PARTICULARS FOR 4CX4.0MM² PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	4CX4 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	4CX4 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/0.85	
8	Diameter of Steel wires	mm	1.25 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	4.61	
12	Nominal thickness of insulation	mm	1 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D+1.0 (min) Calculation to be submitted.	
14	Color of sheath	-	Black	
15	Filler material, Inner Sheath material,			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Color of Core	-	Red, Yellow, Blue, Black	
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/KM	Shall be mentioned	
19	Drum wound length	M	1000	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
			International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.26 GUARANTEED TECHNICAL PARTICULARS FOR 4C X 6.0 MM² PVC INSULATED & PVC SHEATHED CONTROL CABLE

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad, otherwise the bid shall be rejected)

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
1	Name of the Item	-	4CX6 mm ² PVC Insulated and PVC Sheathed Copper Cable with Armoring	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, BDS or equivalent International standards.	
5	Cable Size	mm ²	4CX6 mm ²	
6	Material	-	Plain annealed Copper Cable	
7	Numbers & Diameter of Copper wires	mm	7/1.04	
8	Diameter of Steel wires	mm	1.25 (min.) But if fictitious diameter under the armor is more than 14mm then diameter of steel wire should be 1.6 (min.)	
9	No. of Steel wires	Nos	To be mentioned	
10	Thickness of Steel Tape (galvanized)	mm	0.2 mm (min). But in case of aluminum or aluminum alloy it should be 0.5 mm	
11	Maximum resistance at 20 deg. C	Ω/KM	3.08	
12	Nominal thickness of insulation	mm	1 (min.)	
13	Nominal thickness of sheath	mm	T _s = .035*D + 1.0 (min) Calculation to be submitted.	
14	Colour of sheath	-	Black	
15	Filler material, Inner Sheath material,			
	Thickness of inner sheath	mm	Shall be mentioned	
	Diameter over inner sheath	mm	Shall be mentioned	
16	Colour of Core	-	Red, Yellow, Blue, Black	

Sl. No.	Description	Unit	NESCO'S Requirement	Manufacturer's Guaranteed Data
17	Approximate outer diameter	mm	To be mentioned	
18	Approximate weight	Kg/K M	Shall be mentioned	
19	Drum wound length	M	1000	
20	Net Weight	Kg	Shall be mentioned	
21	Gross weight	Kg	Shall be mentioned	
22	Treated Wooden Drum Standard	-	To be mentioned the name of used latest International standards	
23	Manufacturer must comply all	-	Yes	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.27 GUARANTEED TECHNICAL PARTICULARS FOR ACSR MARTIN

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	ACSR MARTIN	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, ASTM, BDS or equivalent International standards.	
5	Installation	-	Overhead	
6	Type	-	Stranded	
7	Material	-	Hard drawn Aluminum steel reinforced	
8	Overall diameter	mm	36.17	
9	Nominal cross-sectional area of conductor	mm ²	772.10	
10	Number/diameter of Aluminium Strand	No./m m	54/4.02	
11	Nominal Aluminium cross sectional area	mm ²	685.40	
12	Number/diameter of Steel Strand	No./m m	19/2.41	
13	Nominal Steel cross sectional area	mm ²	86.70	
14	Weight of conductor	Kg/K M	2590	
15	Drum wound length	M	500	
16	Net weight	Kg	Shall be mentioned	
17	Gross weight	Kg	Shall be mentioned	
18	Maximum DC Resistance of Conductor at 20 °C	Ω/KM	0.0425	

Sl. No	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
19	Minimum breaking Load of Conductor	Kg	min 11400	
20	Maximum working tension of conductor	KN	Shall be mentioned	
21	Current rating at 35°C rise over 40°C ambient temperature (75°C)	Amps.	Shall be mentioned	
22	Practical (final) modulus of elasticity	hbar	7700	
23	Co-efficient of linear expansion	/°C	shall be mentioned	
24	Aluminum to Steel Ratio	-	Shall be mentioned	
25	Lay length for Outermost Layer of Aluminium	mm	Shall be mentioned	
26	Lay direction for Outermost Layer of Aluminium	-	Right hand	
27	Lay ratio for Outermost Layer of Aluminium	-	10-14	
28	Treated Wooden Drum Standard	-	AWPA C ₁ – 82, C ₂ –83, C ₁₆ –82, P ₅ –83.	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.28 GUARANTEED TECHNICAL PARTICULARS FOR ACSR GROSBEAK

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	ACSR GROSBEAK	
2	Name of the Manufacturer	-	Shall be mentioned	
3	Address of the Manufacturer	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, IEC, ASTM, BDS or equivalent international standards.	
5	Installation	-	Overhead	
6	Type	-	Stranded	
7	Material	-	Hard drawn Aluminium steel reinforced	
8	Overall diameter	mm	25.15	
9	Nominal cross-sectional area of conductor	mm ²	374.70	
10	Number/diameter of Aluminium Strand	No./m m	26/3.97	
11	Nominal Aluminium cross sectional area	mm ²	321.68	
12	Number/diameter of Steel Strand	No./m	7/3.09	

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
		m		
13	Nominal Steel cross sectional area	mm ²	53.02	
14	Weight of conductor	Kg/K M	1304	
15	Drum wound length	M	500	
16	Net weight	Kg	Shall be mentioned	
17	Gross weight	Kg	Shall be mentioned	
18	Maximum DC Resistance of Conductor at 20 °C	Ω/KM	0.0900	
19	Minimum breaking Load of Conductor	Kg	11400	
20	Maximum working tension of conductor	KN	Shall be mentioned	
21	Current rating at 35°C rise over 40°C ambient temperature (75°C)	Amps.	538 (min)	
22	Practical (final) modulus of elasticity	hbar	7700	
23	Co-efficient of linear expansion	/°C	18.9 x 10 ⁻⁶	
24	Aluminum to Steel Ratio		Shall be mentioned	
25	Lay length for Outermost Layer of Aluminium	mm	Shall be mentioned	
26	Lay direction for Outermost Layer of Aluminium	-	Right hand	
27	Lay ratio for Outermost Layer of Aluminium	-	10-14	
28	Treated Wooden Drum Standard	-	AWPA C ₁ – 82, C ₂ – 83, C ₁₆ – 82, P ₅ – 83.	

Seal and Signature
of the manufacturer:

Seal and Signature
of the Bidder:

8.29 GUARANTEED TECHNICAL PARTICULARS FOR DISC INSULATOR

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
01.	Name of the Item	Disc Insulator	
02.	Name of Manufacturer & Address	Shall be mentioned	
03.	Manufacturer's Code No.	To be mentioned	
04.	Standard	Performance, Design and Testing shall be in accordance to the BS, IEC, ASTM, BDS or equivalent International standards.	
05.	Installation	Overhead	

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
06.	Type	Disc	
07.	Material	Porcelain	
08.	Creepage Distance	292 mm	
09.	Flash over voltage Power Frequency, Dry Power Frequency, Wet	78 kV 45 kV	
10.	Withstand Voltage Power Frequency, Dry Power Frequency, Wet	70 kV 40 kV	
11.	Power Frequency Puncture Voltage	110 kV	
12.	50% Impulse flashover Positive	120 kV	
13.	50% Impulse flashover Negative	125 kV	
14.	Mechanical Failing Load	70 KN	
15.	Nominal Diameter	255 mm	
17.	Minimum Spacing	146 mm	
18.	Dry Arching Distance minimum	171 mm	
19.	Coupling Size	16 mm	
20.	Weight in Kg	To be mentioned	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder

8.30 GUARANTEED TECHNICAL PARTICULARS OF 33 KV BUS BAR INSULATOR STRING

(To be filled up by the Manufacturer in Manufacturer Letterhead with appropriate data)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
1	Manufacturer's Name & Country	-	To be mentioned	
2	Manufacturer's model no.	-	To be mentioned	
3	Insulator material	-	Porcelain	
4	Number of units per string	Nos.	3	
5	Insulator Voltage Class	KV	15	
6	Insulator Materials		Porcelain	
7	Type of Insulator	-	Ball and socket type disc, security clip made of rod brass alloy.	
8	Creepage/ leakage distance (min.)	mm	298	
9	Total creepage distance of string	mm	850	
10	Unit Spacing	mm	146	
11	Dry Arcing distance (minimum)	mm	1968	
12	Diameter of Insulator	mm	256	

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
13	Withstand Voltage, Minimum :			
	a) Power Frequency, dry (one min.)	KV	70	
	b) Power Frequency, wet (one min.)	KV	40	
	c) Impulse 1.2/50 μ sec	KV	110	
14	Flashover Voltage, Minimum :			
	a) Power Frequency, dry	KV	80	
	b) Power Frequency, wet	KV	50	
	c) 50% Impulse 1.2/50 μ sec wave, positive or impulse 1.2/50 μ sec wave positive.	KV	125	
	d) 50% Impulse 1.2/50 μ sec wave Negative	KV	130	
15	Power Frequency Puncture Voltage, minimum	KV	110	
16	Radio Influence Voltage Data, minimum			
	a) Power frequency test voltage RMS to Ground	KV	10	
	b) Maximum RIV at 1,000 Kc	μ V	50	
17	Minimum Mechanical Strength for Suspension :			
	a) Electro-mechanical Breaking Load	Kg	7260	
	b) Mechanical Breaking load	Kg	6800	
	c) Tension Proof Test Load	Kg	3400	
	d) Time Load Test Value	Kg	4536	
	e) Mechanical Impact Strength	mm Kg	630	
18	Minimum Mechanical Strength for Strain Stringing :			
	a) Electro-mechanical Breaking Load	Kg	11340	
	b) Mechanical Breaking load	Kg	11340	
	c) Tension Proof Test Load	Kg	3400	
	d) Time Load Test Value	Kg	4536	
	e) Mechanical Impact Strength	mm Kg	530	
19	Insulator Hardware	-	Insulator hardware for insulator strings or bus-support such shall have UTS-120 KN and galvanized as per BS-729 OR ASTM A-153.	
20	Standard	-	AS per latest editions of IEC-60383-1, IEC-60383-2.	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.31 GUARANTEED TECHNICAL PARTICULARS FOR H-TYPE CONNECTOR

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
Compatible for ACSR GROSBEAK			
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	Design, Testing & Performance shall be in accordance to BS, IEC, BDS, ANSI, ASTM or equivalent international standards.	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	H-Type	
6.	Material	Aluminium	
7.	Minimum Continuous Current rating at 35°C rise over 40°C ambient temperature (75°C)	628 Amps (min).	
8.	Length	Shall be mentioned (Subject to approval)	
9.	Weight of 100 nos. in Kg	Shall be mentioned	

Seal and Signature
of the manufacturer:

Seal and Signature
of the Bidder:

8.32 GUARANTEED TECHNICAL PARTICULARS FOR GUY/EARTH WIRE.

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Unit	Purchaser's Requirement	Manufacturer's Particulars
1	Name of the Item	-	Guy/Earth Wire	
2	Name &v Address of the Manufacturer	-	Shall be mentioned	
3	Manufacturer's Code No.	-	Shall be mentioned	
4	Standard	-	Performance Design and Testing shall be in accordance to the BS, BDS or equivalent International standards.	
5	Installation	-	Overhead/Stay	
6	Type	-	Stranded, Solid and Bare	
7	Material	-	High Strength Steel	
8	Overall diameter	mm	9.50	

9	Number/diameter of each strand	No./mm	7/3.15	
10	Nominal cross sectional area of conductors	mm ²	54.53	
11	Weight of Guy Wire	Kg/KM	430	
12	Ultimate Tensile Strength	KN	62.75	
13	Galvanisation	-	As per ASTM B498-74, Class-A	
14	Modulus of Elasticity	Kg/mm ²	19.7 x 10 ³	
15	Coefficient of linear expansion	/°C	11.3 x 10 ⁻⁶	
16	Drum wound length	M	1500	
17	Net weight	Kg	Shall be mentioned	
18	Gross weight	Kg	Shall be mentioned	
19	Lay length	mm	Shall be mentioned	
20	Lay direction	-	Right hand	
21	Lay ratio	-	13-18	
22	Treated Wooden Drum Standard	-	AWPA C ₁ – 82, C ₂ – 83, C ₁₆ – 82, P ₅ – 83.	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

8.33 GUARANTEED TECHNICAL PARTICULARS FOR PG CLAMP

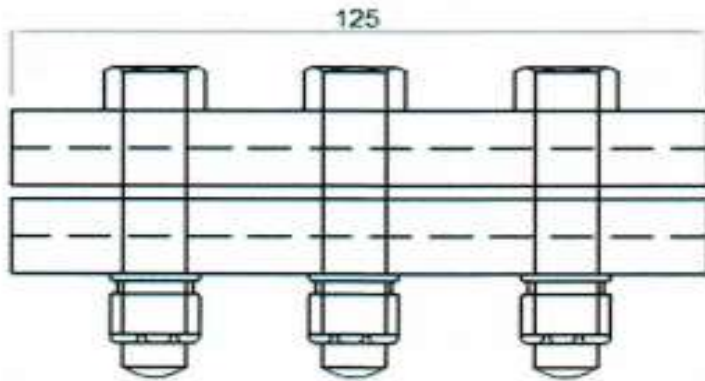
(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	Purchaser's Requirement	Manufacturer's Particulars
Compatible for ACSR GROSBEAK to ACSR GROSBEAK			
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	Design, Testing & Performance shall be in accordance to BS, IEC, BDS, ANSI, ASTM or equivalent international standards.	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy	
7.	Minimum Continuous Current rating at 35°C rise over 40°C ambient temperature (75°C)	628 Amps (min).	
8.	Dimension	125 mm x 50 mm	
9.	Weight of 100 nos. in Kg	Shall be mentioned	

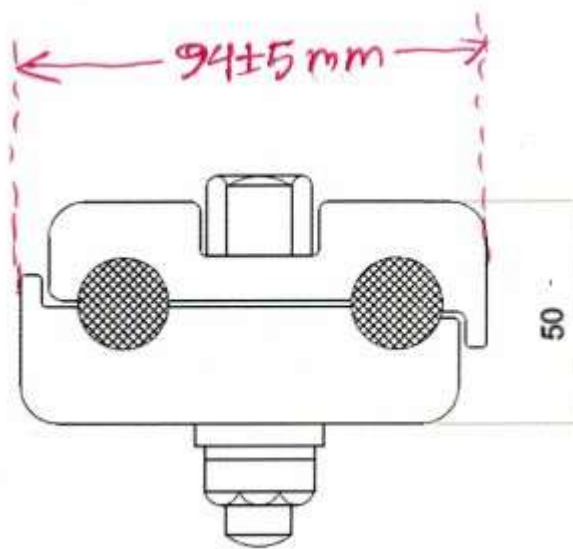
Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

Drawing FOR 33 KV PG CLAMP (ACSR GROSBEAK)



Drg. No: 2.3.45.1



Drg. No: 2.3.45.1

Notes:

1. Dimensions : In mm
2. No. of M12 Bolts : 03
3. Tolerances :
Material Sizes : ± 1 mm
Thickness : -0%, 10%

This is a conceptual drawing. All measurement will be approved during drawing approval as per relevant standard.

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.34 GUARANTEED TECHNICAL PARTICULARS OF STEEL STRUCTURE DESIGN

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad with appropriate data)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
1	Manufacturer's Name and Country	-	To be mentioned	
2	Maximum ratio of unsupported length of steel compression to their least radius of gyration:			
	a) Main members	Mm	120	
	b) Bracing's	Mm	180	
	c) Redundant	Mm	180	
3	BS EN 10025-1 to 10025-6 standard :			
	a) Steel Grade	-	Grade is to be mentioned According to Submitted Calculation	
	b) Tensile Stress, Yield Strength, impact Energy with calculation	Mpa	To be mentioned	
	c) Co-Efficient Of Thermal Expansion	degree	To be mentioned	
5	Formula for calculation of ultimate stress in compression.	-	$SC = F/S[1 + \{LE/\pi^2 E\} \times \{(L/R)^2/M\}]$	
	Where,			
	SC = Ultimate stress in compression	Kg/mm ²	To be mentioned	
	F = Yield strength	Kg	To be mentioned	
	S = Section	mm ²	To be mentioned	
	L/R = Length / Radius of gyration	Cm	To be mentioned	
	LE = Elastic limit stress	Mg/mm ²	24 or 36	
	E = Elasticity module	Kg/mm ²	22000	
	M = Rigidity Coefficient at each end	-	To be mentioned	
	M=1 with only one bolt at each end of member	-	To be mentioned	
	M=2 with two bolts at each end of a member	-	To be mentioned	
	M=4 if L/R between 110 and 130	-	To be mentioned	
	M=3 if L/R over to 130	-	To be mentioned	
6	Minimum size of member	Mm	45 x 45 x --	
7	Weight of each Column	Kg	To be mentioned	
8	Weight of each Girder	Kg	To be mentioned	
9	Total weight	Kg	To be mentioned	
10	Details Calculation	-	Calculation must	

			be submitted otherwise it will not be accepted.	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.35 GUARANTEED TECHNICAL PARTICULARS OF SHIELD WIRE, EARTHING GRID AND EARTHING ELECTRODE

(To be filled up by the Manufacturer in Manufacturer Letterhead Pad with appropriate data)

Sl. No.	Description	Unit	NESCO's Requirement	Manufacturer's guaranteed Particulars
A. SHIELD WIRES				
1	Manufacturer's name & country	-	To be mentioned	
2	Material	-	High Strength Steel	
3	Grade of Steel	Kg	60000	
4	Nos. of Strand	Nos.	7	
5	Diameter of each strand	Mm	3.05	
6	Overall diameter	Mm	9.525	
7	Nominal cross-section	mm ²	51.14	
8	Weight per km length	Kg	407	
9	Maximum rated current (3 seconds)	A	To be mentioned	
10	Maximum working tension of main connection	Kg/m ²	To be mentioned	
11	Resistance of conductors per 1000 meters at 20 c	Ohms	To be mentioned	
12	Rated Ultimate Tensile Strength	Kg/m m ²	4900	
13	Maximum permissible span length	M	To be mentioned	
14	Maximum sag under own weight of maximum span	Mm	To be mentioned	
15	Co-efficient of liner expansion	cm/ °C.	To be mentioned	
16	Class of Zinc Coating	-	Class-A	
17	Galvanization	-	As per BS EN ISO 1461:2009 Or ASTM A-153	
B. EARTHING GRID				
1	Manufacturer's name & country	-	To be mentioned	
2	Material	-	Copper	
3	Overall diameter	Mm	To be mentioned	
4	Nominal cross-section			
	a) Interconnecting the earth electrodes (all type)	mm ²	To be mentioned	
	b) Connecting equipment to mesh (all type)	mm ²	To be mentioned	
6	Area of each earthing grid	m x m	To be mentioned	
7	Depth of bedding of conductor	mm	To be mentioned	
8	Maximum earth fault current for 3 sec.	KA	40	
9	Resistance of conductors per 1000 meters at	Ohms	To be mentioned	

	20 ⁰ c			
C.	EARTHING ELECTRODES			
1	Manufacturer's name & country	-	To be mentioned	
2	Material	-	Copper	
3	Dimensions : a) Dia b) Length	mm Meter	16 As per design	
4	Number of electrodes per group	-	As per schedule	
5	Number of earthing point per substation	-	To be mentioned	
6	Calculated resistance of combined earth grid and points	Ohm	0.35 (At testing Time) 0.30 (At Design Calculation)	

Seal & Signature of the Manufacturer

Seal & Signature of the Bidder

8.36 GUARANTEED TECHNICAL PARTICULARS FOR 33 KV FLAT I-TYPE CONNECTOR (25 MM) ***

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	NESCOs Requirement	Manufacturer's Particulars
Compatible for ACSR GROSBEAK			
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	BS, IEC, BDS or equivalent international standard	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy (LM6 or higher grade)	
7.	Material Composition	Details percentage of materials	
8.	Minimum continuous current rating at 35°C rise over 40°C ambient temperature (75°C)	Shall be mentioned and capable of carrying the continuous current of the specified conductor in Amps.	
9.	All Dimensions, Dia and Hole Size	Shall be as per drawing Figure No: 01	
10.	Weight of 100 nos. in Kg	Shall be mentioned	
11.	Dimensional Drawing	Shall be enclosed	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

***** This GTP has been used as an example. Bidder has to submit GTP & Drawing of all type of connectors to be used in the substation in a similar format.**

DRAWING OF 33 Kv Flat I-Type Connector (25 mm)

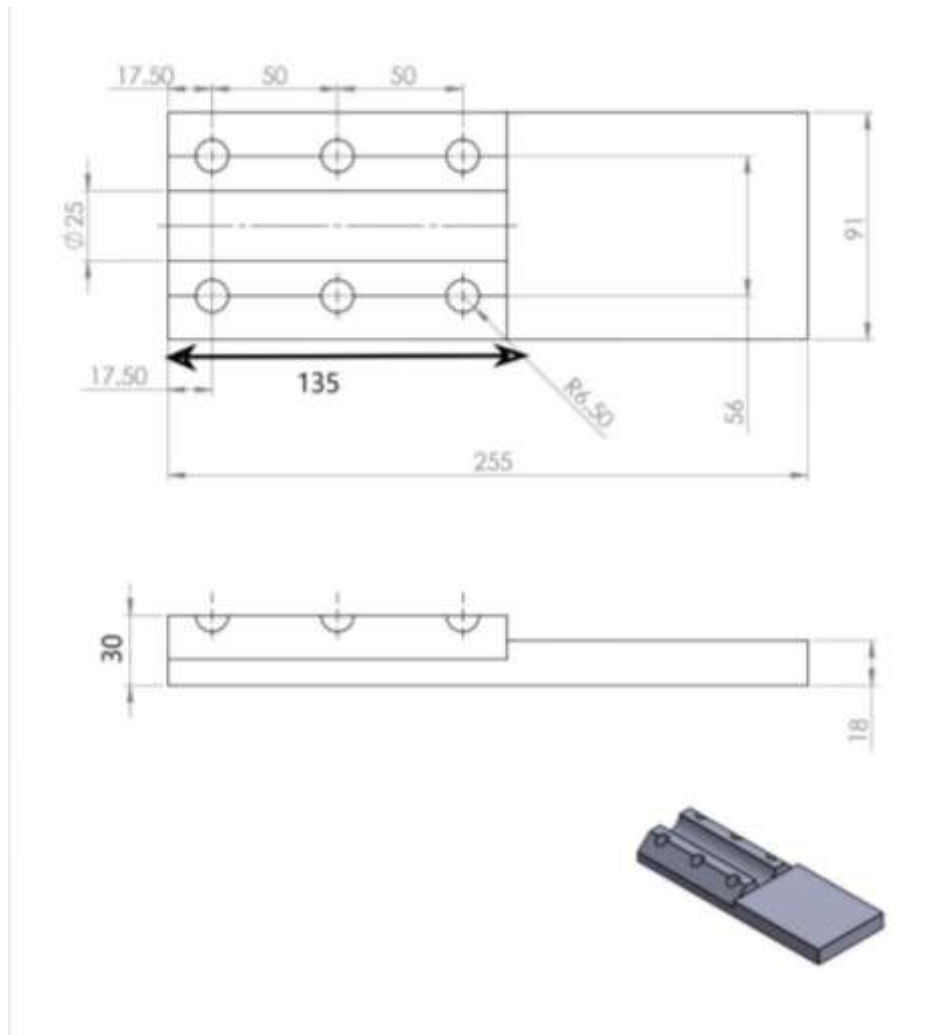


Figure. No: 01

***** Dimension of all the connectors has to be similar to the above drawing i.e; hole diameter can be different but thickness, length etc. have to be similar to the above drawing. Dimensions of all type of connector will be finalized during design approval.**

8.37 GUARANTEED TECHNICAL PARTICULARS (GTP) FOR 33 KV T-TYPE CONNECTOR (25/25 MM)

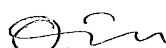
(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate date)

Sl. No.	Description	NESCO's Requirement	Manufacturer's Particulars
Compatible for ACSR GROSBEAK to ACSR GROSBEAK			
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	BS, IEC, BDS or equivalent international standard	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy (LM6 or higher grade)	
7.	Material Composition	Details percentage of materials	
8.	Minimum continuous current rating at 35°C rise over 40°C ambient temperature (75°C)	Shall be mentioned and capable of carrying the continuous current of the specified conductor in Amps.	
9.	All Dimensions, Dia and Hole Size	Shall be as per drawing Figure. No: 02 (To be confirmed)	
10.	Weight of 100 nos. in Kg	Shall be mentioned	
11.	Dimensional Drawing	Shall be enclosed	

Seal And Signature of The Manufacturer

Seal And Signature of The Bidder

DRAWING OF 33 KV T-type Connector (25/25 mm)

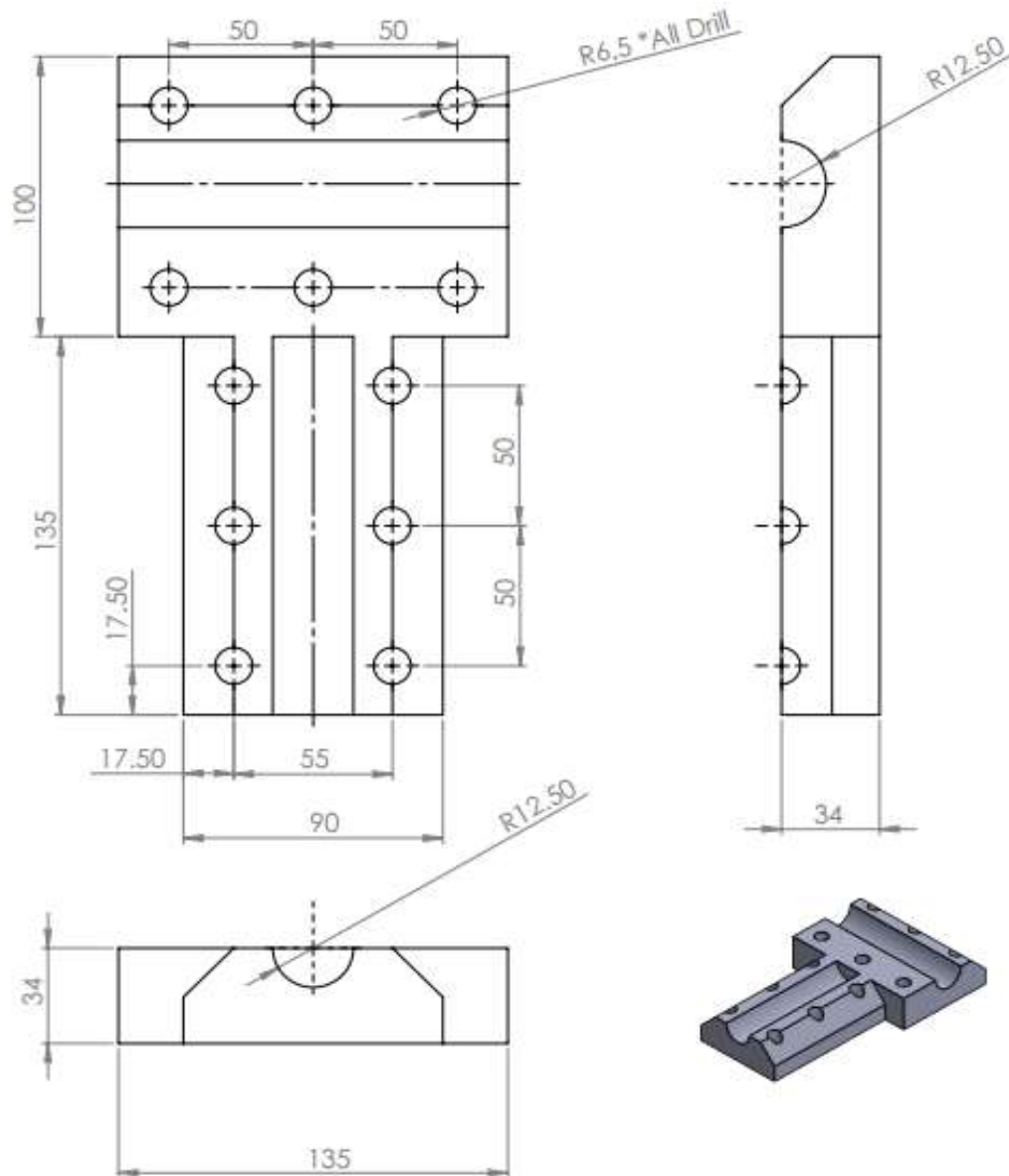



Figure. No: 02

Notes:

1. Dimensions : In mm
2. No. of M12 Bolts : 12
3. Tolerances :
 Material Sizes : ± 1 mm
 Thickness : -0%, 10%

This is a conceptual drawing. All measurement will be approved during drawing approval as per relevant standard.

8.38 GUARANTEED TECHNICAL PARTICULARS (GTP) FOR 33 KV T-TYPE CONNECTOR (36/25 MM)

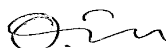
(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriate date)

Sl. No.	Description	NESCO's Requirement	Manufacturer's Particulars
Compatible for ACSR MARTIN to ACSR GROSBEAK			
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	BS, IEC, BDS or equivalent international standard	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy (LM6 or higher grade)	
7.	Material Composition	Details percentage of materials	
8.	Minimum continuous current rating at 35°C rise over 40°C ambient temperature (75°C)	Shall be mentioned and capable of carrying the continuous current of the specified conductor in Amps.	
9.	All Dimensions, Dia and Hole Size	Shall be as per drawing Figure. No: 03 (To be confirmed)	
10.	Weight of 100 nos. in Kg	Shall be mentioned	
11.	Dimensional Drawing	Shall be enclosed	

Seal and Signature of the Bidder

Seal & Signature of the Manufacturer

DRAWING OF 33 KV T-TYPE CONNECTOR (36/25 mm)

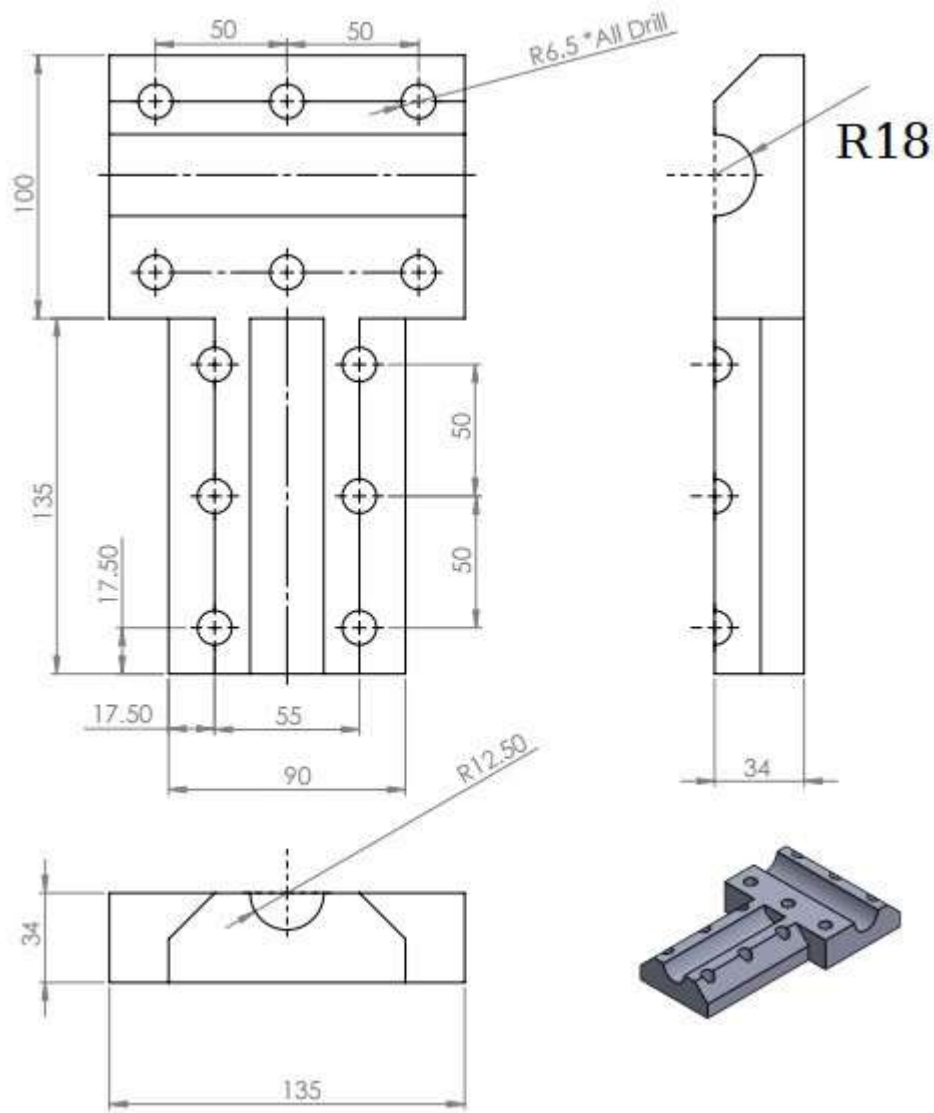



Figure. No: 03

Notes:

1. Dimensions : In mm
2. No. of M12 Bolts : 12
3. Tolerances :
 Material Sizes : ± 1 mm
 Thickness : -0%, 10%

This is a conceptual drawing. All measurement will be approved during drawing approval as per relevant standard.

8.39 GUARANTEED TECHNICAL PARTICULARS (GTP) FOR 33 KV L-TYPE CONNECTOR.

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	NESCOs Requirement	Manufacturers Particulars
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	BS, IEC, BDS or equivalent international standard	
4.	Installation	Outdoor and shall be installed for the ACSR Grosbeak/Martin conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy (LM6 or higher grade)	
7.	Material Composition	Details percentage of materials	
8.	Minimum continuous current rating at 35°C rise over 40°C ambient temperature (75°C)	Shall be mentioned and capable of carrying the continuous current of the specified conductor in Amps.	
9.	All Dimensions, Dia and Hole Size	Shall be as per drawing Figure. No: 04 (To be confirmed)	
10.	Weight of 100 nos. in Kg	Shall be mentioned	
11.	Dimensional Drawing	Shall be enclosed	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

DRAWING OF 33 KV L-TYPE CONNECTOR

Notes:

1. Dimensions : In mm
2. Tolerances :
Material Sizes : ± 1 mm
Thickness : -0%, 10%

This is a conceptual drawing. All measurement will be approved during drawing approval as per relevant standard.

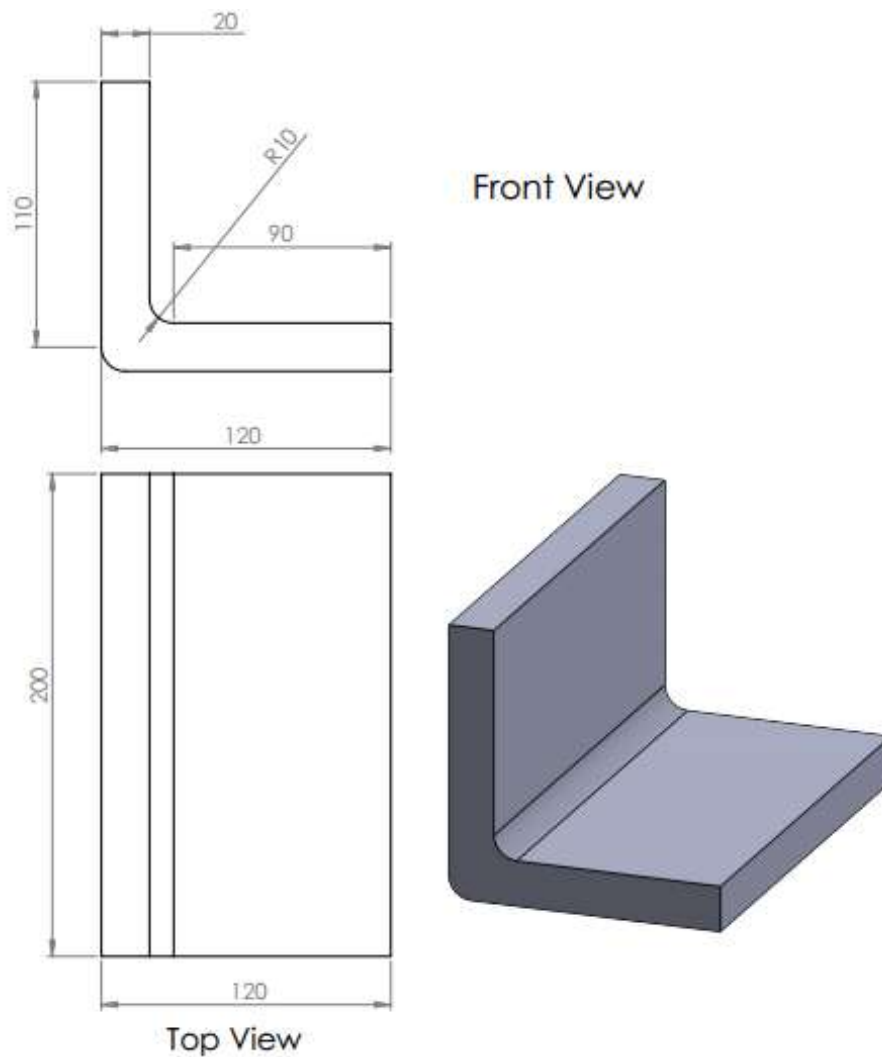


Figure. No: 04

8.40 GUARANTEED TECHNICAL PARTICULARS (GTP) FOR 33 KV Double I-TYPE CONNECTOR (36/25 MM)

(To be filled up by the Manufacturer in Manufacturer's Letterhead Pad with appropriated data)

Sl. No.	Description	NESCOs Requirement	Manufacturers Particulars
Compatible for ACSR MARTIN to ACSR GROSBEAK			
1.	Name & Address of the Manufacturer	Shall be mentioned	
2.	Manufacturer's Code No.	Shall be mentioned	
3.	Applicable Standard	BS, IEC, BDS or equivalent international standard	
4.	Installation	Outdoor and shall be installed for the above-mentioned conductor.	
5.	Type	Bolted Type	
6.	Material	Aluminium Alloy (LM6 or higher grade)	
7.	Material Composition	Details percentage of materials	
8.	Minimum continuous current rating at 35°C rise over 40°C ambient temperature (75°C)	Shall be mentioned and capable of carrying the continuous current of the specified conductor in Amps.	
9.	All Dimensions, Dia and Hole Size	Shall be as per drawing Figure. No: 05 (To be confirmed)	
10.	Weight of 100 nos. in Kg	Shall be mentioned	
11.	Dimensional Drawing	Shall be enclosed	

Seal and Signature of the manufacturer:

Seal and Signature of the Bidder:

Drawing FOR 33 KV Double I-TYPE CONNECTOR (36/25 mm)

Notes:

1. Dimensions : In mm
2. No. of M12 Bolts : 12
3. Tolerances :
Material Sizes : ± 1 mm
Thickness : -0%, 10%

This is a conceptual drawing. All measurement will be approved during drawing approval as per relevant standard.

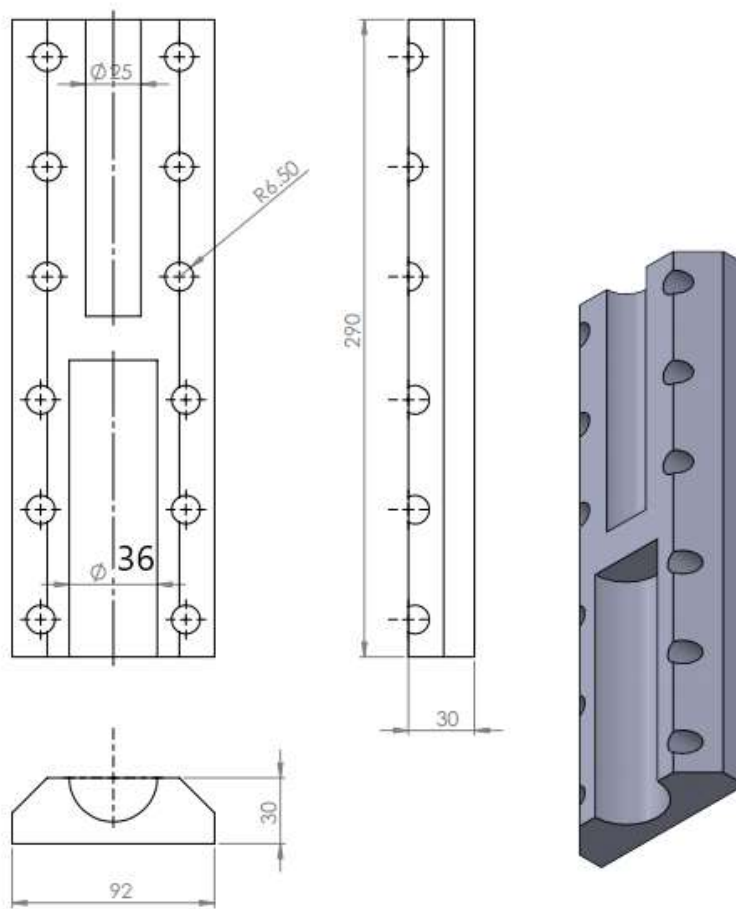


Figure. No: 05

Section 9. Drawings



Figure. No: 06 (Approved Layout)





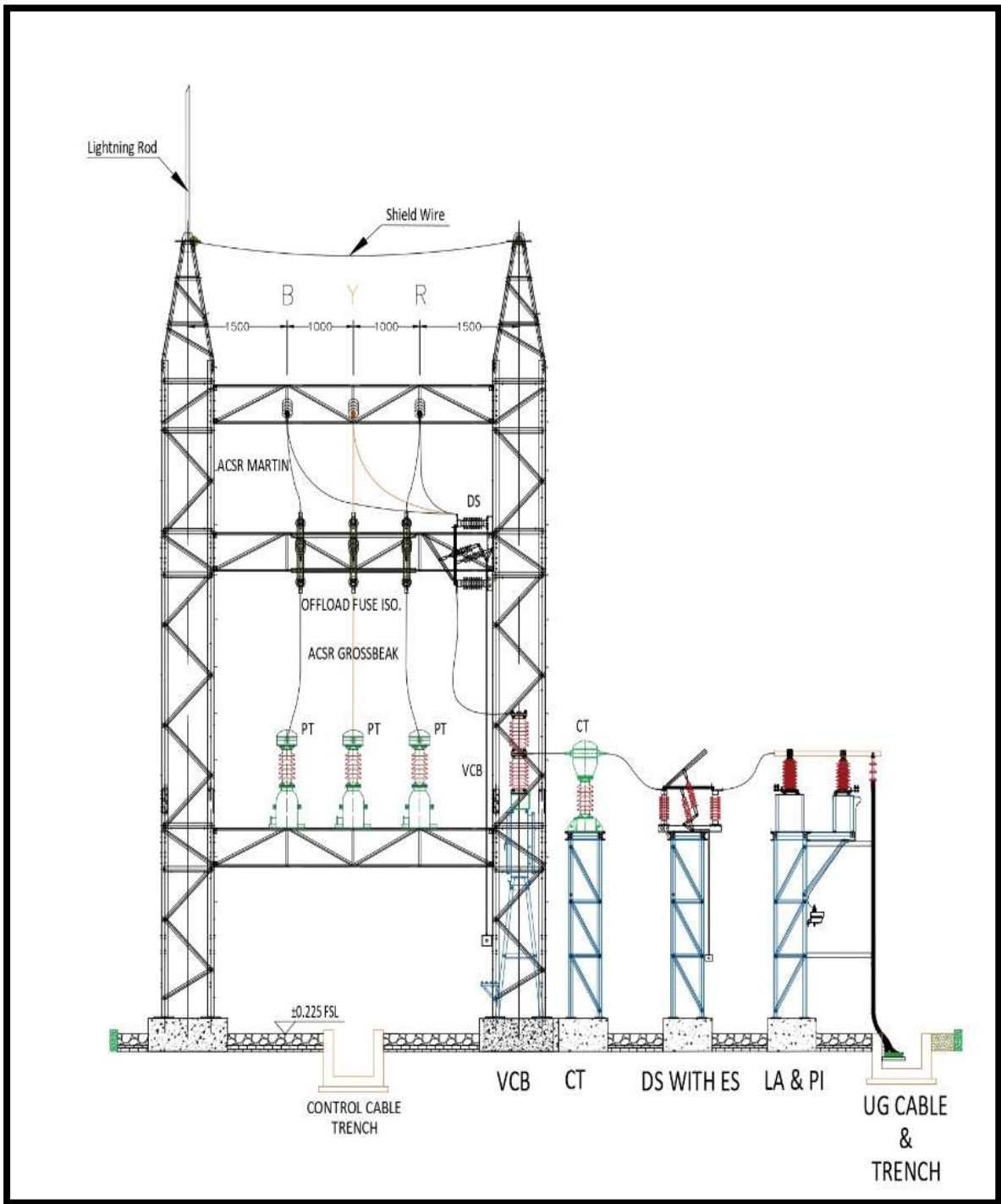


Figure. No: 07 (For 02 Nos Line Feeder for NESCO with underground Cable Arrangements)

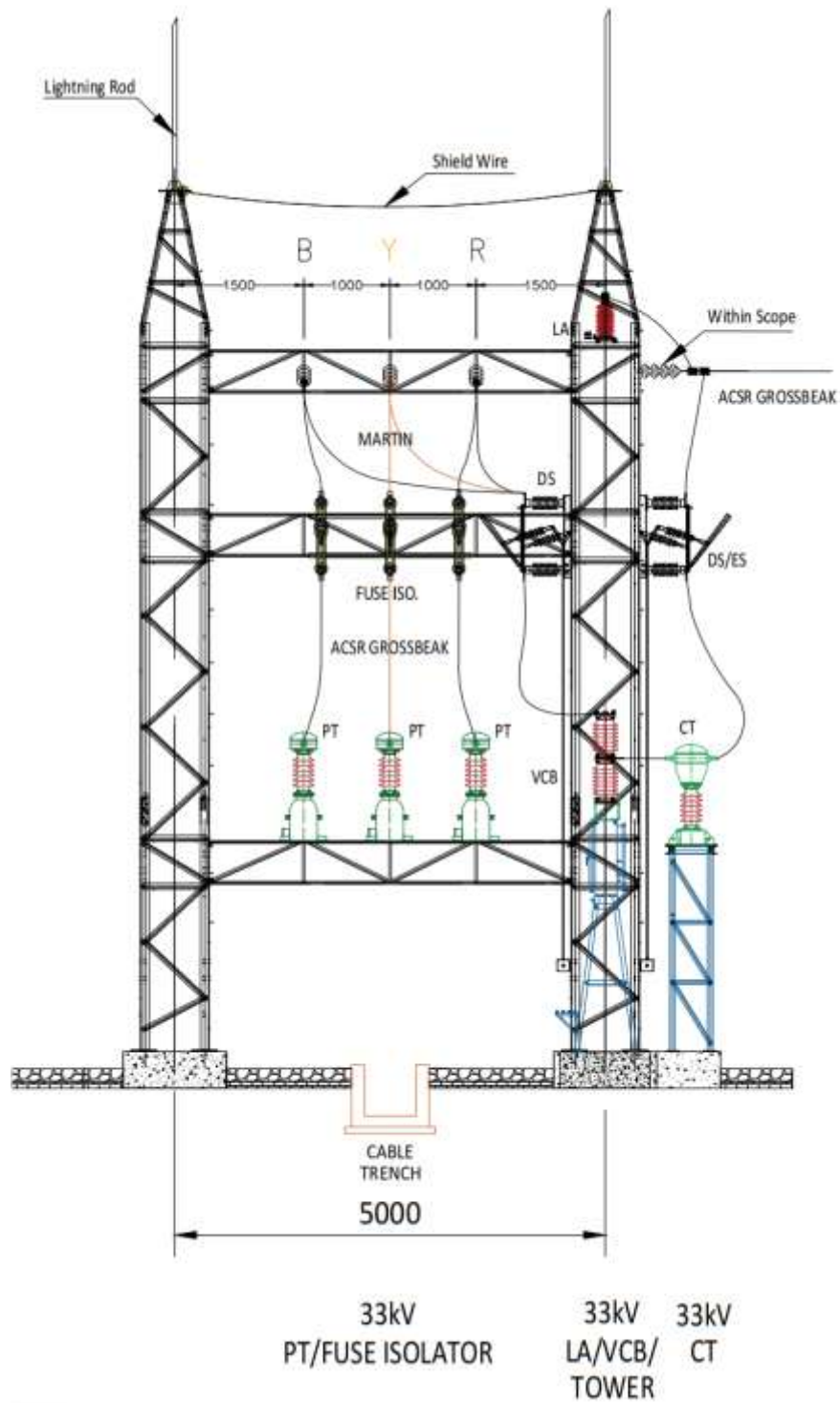


Figure. No: 08 (For 02 Nos Line Feeder for PBS with overhead line Arrangements)

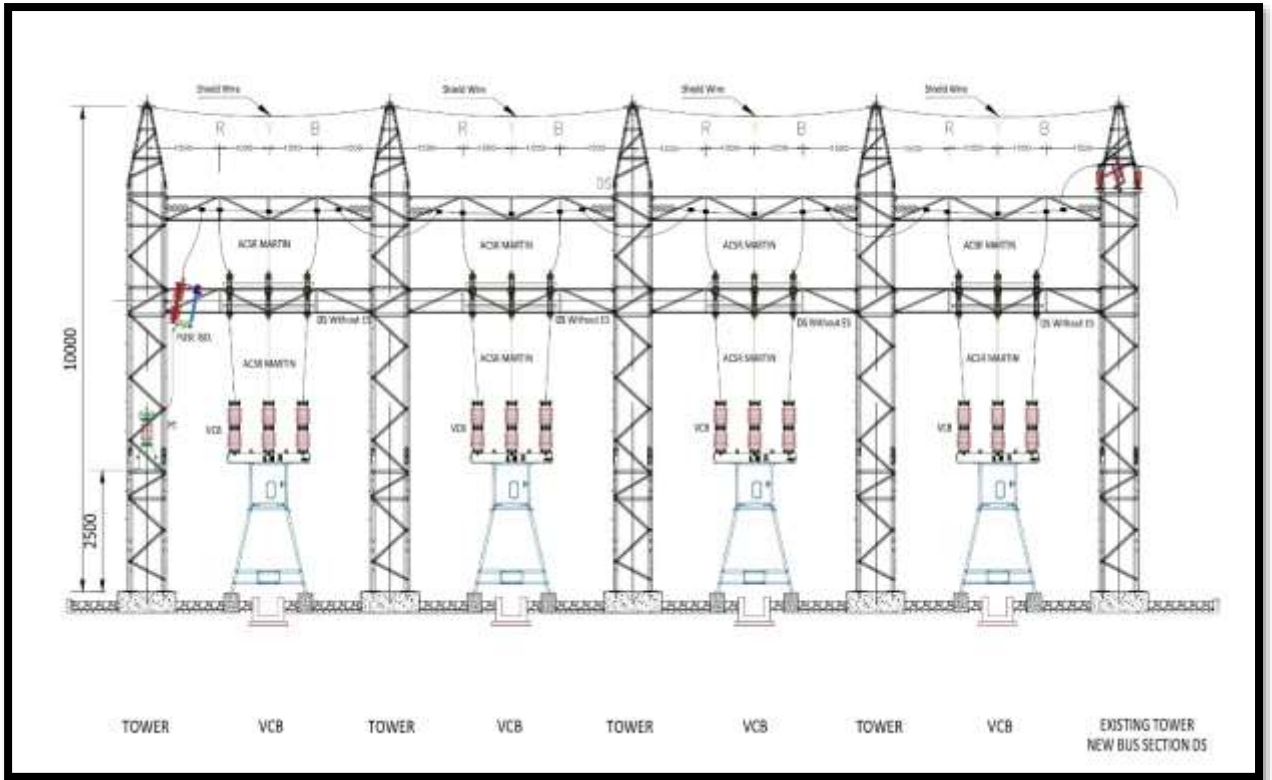


Figure. No: 09 (Load View)

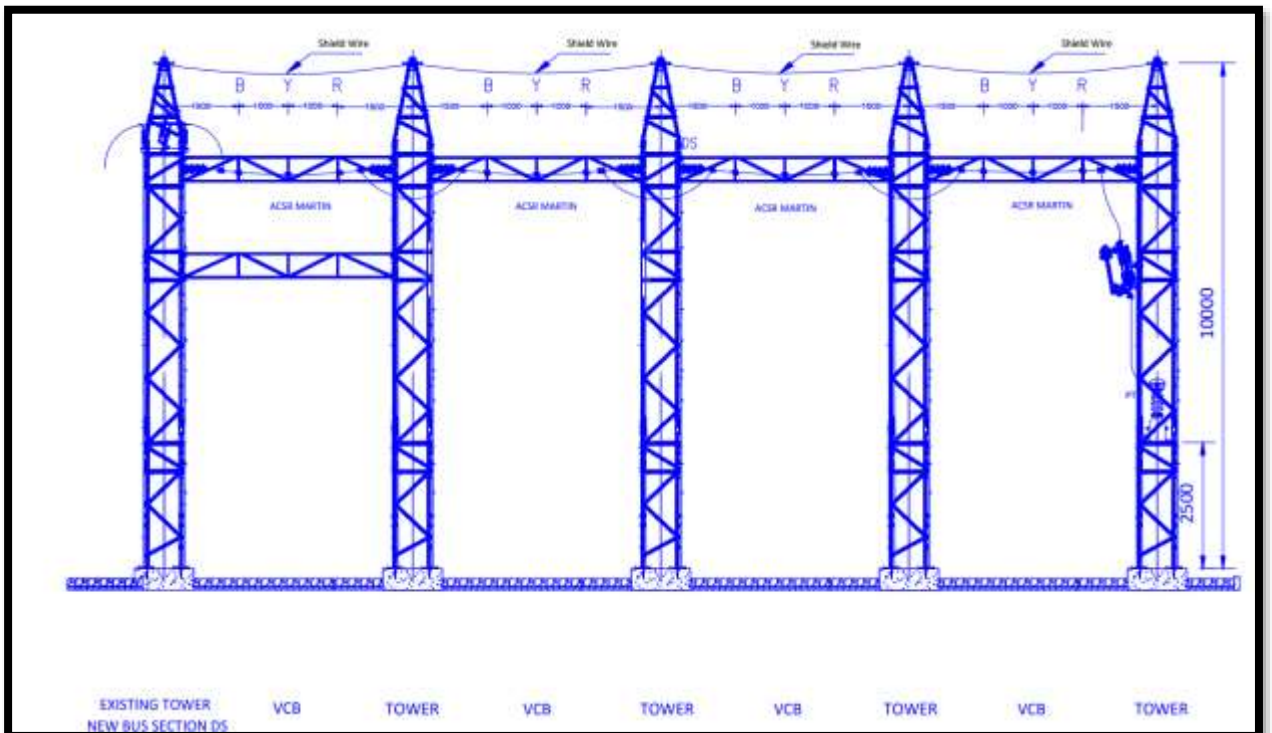


Figure. No: 10 (Source View)