বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

ISO 9001, ISO 14001 &
OHSAS 18001 Certified

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

TENDER DOCUMENT
FOR THE

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

TENDER PACKAGE NO: SE(G&SS)-33KVBB-BagerhatGr-01

Single Stage: Single Envelope Bidding Procedure

ISSUED TO: …….....……

ON BEHALF OF THE OFFICE OF THE
Superintending Engineer (Grid & Sub-Station),
Bangladesh Rural Electrification Board

SEAL & SIGNATURE

"শেখ হাসিনার উদ্যোগ-ঘরে ঘরে বিদ্যুৎ"

Invitation for Tender (Local)
Bangladesh Rural Electrification Board
Government of The People's Republic of Bangladesh

1	Ministry/Division	Ministry of Power, Energy & Mineral Resources/ Power Division.	
2	Agency	Bangladesh Rural Electrification Board.	
3	Name of Procuring Entity & District	Superintending Engineer (Grid & Sub-Station), Bangladesh Rural Electrification Board, Dhaka.	
4	Invitation For Tender Name	TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.	
5	Invitation Reference No. & Date	Memo No: 27.12.2637.173.31.154.17.555 Date: 30 - 11 - 2017	
KEY INFORMATION			
6	Procurement Method	Open Tendering Method (OTM), NCT	
FUNDING INFORMATION			
7	Budget and source of Fund	Bagerhat PBS Fund	
8	Development Partners (if applicable)	N/A	
PARTICULAR INFORMATION			
09	Project / Programme Name	N/A	
10	Tender Package No.	SE(G&SS)-33KVBB- BagerhatGr-01	
11	Tender Publication Date	05 - 12 - 2017.	
12	Tender Last Selling Date & Time.	03 -01 - 2018 within office hour. BST.	
TENDER CLOSING & OPENING		**Date**	**Time**
13	Tender Closing Date & Time.	04 -01-2018	12:00 Noon (BST)
14	Tender opening Date & Time.	04- 01-2018	12:30 Noon (BST)
15	Pre-Tender Meeting: Date & Time	14 -12-2017	11:00 AM (BST)
16	**Name & Address of the Office**	**Address**	
	- For Selling Tender Document - For Receiving Tender Document - For Opening Tender Document - For Pre-Tender Meeting	Office of the Superintending Engineer (Grid & Sub-Station) BREB, Training Academy Building (4th floor), Nikunja-2, Khilkhet, Dhaka-1229.	
INFORMATION FOR TENDERER			
17	Eligibility of Tender	General Experience: The minimum number of general experience of the Tenderer in the construction works/supply of goods and related service as Prime Contractor or Sub-contractor or a Management Contractor shall be 5 (five) years. i) **Specific experience:-** In the case of single entity the minimum specific experience as a Prime Contractor or Subcontractor or Management Contractor in construction works at least 1(one) contract(s) of 33KV Switching Station or 132/33KV Sub Station or 33/11 KV Indoor Sub-station successfully completed within the last 05 years, each with a value of at least **BDT 115.19 Lakh.** ii) Joint venture, Consortium or Association (JVCA) may be made by 01(one) supply contractor and 01(one) construction contractor. In that case, the leading partner must have successfully completed at least 01 (one) contract of 33KV Switching Station or 132/33KV Sub Station or 33/11 KV Indoor Sub-station within the last 05(five) years each with a value of at least **BDT 115.19 Lakh.**	
18	Price of Tender Document (TK)	Tk 8,000/- (Taka Eight Thousand Only) Per Document.	
19	Short Description of the Package:		

Bid Package No.	Location / Description of Works	Quantity	Tender Security Amount in TK	Completion Time.
SE(G&SS)-33KVBB- BagerhatGr-01	TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.	01 (One) No.	11.50 (Lac)	6 (Six) Months.

20	Regarding Tender Document	Tender Document can be purchased by the interested on submission of a written application in the address below upon the payment of non-refundable Tk. 8,000/- (Taka Eight Thousand) in the form of Bank Draft/Pay order in favor of General Manager, Bagerhat PBS, Bagerhat, Bangladesh. No Tender Document will be sent by courier or by mail.
21	Mode of Payment	Payment will be made directly to the Tenderers in Local Currency (BDT) by BAGERHAT PBS
22	Completion Period	Completions Periods shall begin with effect from the date of signing of contract on 28th day from the date of notification of award which to be earlier.
23	Special Instruction	Tender Document can be viewed in the BREB & BAGERHAT PBS website. *www.reb.gov.bd* & *www.bagerhatpbs.org.bd*
PROCURING ENTITY DETAILS		
24	Name of Official Inviting Tender	Anjan Kanti Das
25	Designation of Official Inviting Tender	Superintending engineer
26	Address of Official Inviting Tender	Office of the Superintending engineer (Grid & Sub-Station), BREB, Dhaka.
27	Contract details of officeal Inviting Tender	Tel: 8900757
28	The procuring entity reserves the right to accept to reject all tenders.	

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

BANGLADESH RURAL ELECTRIFICATION BOARD
(ISO Standard : 9001-2008)

ISO 9001, ISO 14001 & OHSAS 18001 Certified

বাপবিবো/জন (----------) ২০১৭-২০১৮

Office of the Superintending Engineer (Grid & Sub-Station)
Bangladesh Rural Electrification Board,
4th Floor, Training Academy Building,
Nikunja-2, Khilkhet, City:Dhaka-1229,
Country:Bangladesh.
Tel: + 8802- 8900757
E-mail: segridssbreb@gmail.com
Web site: www.reb.gov.bd

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

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TENDER PACKAGE NO: SE(G&SS)-33KVBB- BagerhatGr-01

VOLUME 1 OF 3

SECTION: 1- Instruction To Tenderers (ITT)
SECTION: 2- Tender Data Sheet (TDS)
SECTION: 3- General Conditions of Contract (GCC)
SECTION: 4- PCC, Labour Laws
SECTION: 5- Tender and Contract Forms
SECTION: 6- Bill of Quantity

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

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I N D E X TO V O L U M E S

Volume 1 of 2

- **Section : 1 Instruction to Tenders (ITT)**
- **Section : 2 Tender Data Sheet (TDS)**
- **Section : 3 General Conditions of Contract (GCC)**
- **Section : 4**
  Part I Particular Conditions of Contract (PCC)
  Part II Labour Laws
- **Section : 5 Tenders and Contract Forms**
  Form PW3-1 : Tender Submission Letter
  Form PW3-2 : Tenderer Information
  Form PW3-3 : JV Partner Information.
  Form PW3-4 : Sub-contractor Information
  Form PW3-5 : Personnel Information
  Form PW3-6 : Bank Guarantee for Tender Security
  Form PW3-8 : Notification of Award
  Form PW3-9 : Contract Agreement
  Form PW3-10 : Bank Guarantee for Performance Security

Section : 6 Bill of Quantity

Volume 2 of 2

SECTION :7 - GENERAL SPECIFICATION

Scope of Work

Section : 8 - PARTICULAR SPECIFICATION

Section : 9 - DRAWINGS

Table of Contents

VOLUME 1 OF 3 iii

Section 1. Instructions to Tenderers 10

A. General 10
1. Scope of Tender 10
2. Interpretation 10
3. Source of Funds 10
4. Corrupt, Fraudulent, Collusive,Coercive (or Obstructive in case of Development Partner) Practices 11
5. Eligible Tenderers 13
6. Eligible Materials, Equipment and Associated Services 14
7. Site Visit 14

B. Tender Document 14
8. Tender Document: General 14
9. Clarification of Tender Document 15
10. Pre-Tender Meeting 15
11. Addendum to Tender Document 15

C. Qualification Criteria 16
12. General Criteria 16
13. Litigation History 17
14. Experience Criteria 17
15. Financial Criteria 17
16. Personnel Capacity 17
17. Equipment Capacity 18
18. Joint Venture (JV) 18
19. Subcontractor(s) 18

D. Tender Preparation 19
20. Only one Tender 19
21. Cost of Tendering 19
22. Issuance and Sale of Tender Document 19
23. Language of Tender 19
24. Contents of Tender 19
25. Tender Submission Letter and Bill of Quantities 20
26. Alternatives 20
27. Tender Prices, Discounts and Price Adjustment 21
28. Tender Currency 21
29. Documents Establishing Eligibility of the Tenderer 21
30. Documents Establishing the Eligibility and Conformity of Materials, Equipment and Services 22
31. Documents Establishing Technical Proposal 22
32. Documents Establishing the Tenderer's Qualification 22
33. Validity Period of Tender 23
34. Extension of Tender Validity and Tender Security 23
35. Tender Security 23
36. Form of Tender Security 24
37. Authenticity of Tender Security 24
38. Return of Tender Security 24
39. Forfeiture of Tender Security 25
40. Format and Signing of Tender 25

E. Tender Submission 25

41. Sealing, Marking and Submission of Tender 25
42. Deadline for Submission of Tender 26
43. LateTender 26
44. Modification, Substitution or Withdrawal of Tender 26
45. Tender Modification 26
46. Tender Substitution 27
47. Tender Withdrawal 27

F. Tender Opening and Evaluation 27

48. Tender Opening 27
49. Evaluation of Tenders 28
50. Evaluation Process 28
51. Preliminary Examination 30
52. Technical Responsiveness and Technical Evaluation 30
53. Clarification on Tender 31
54. Restrictions on Disclosure of Information 31
55. Correction of Arithmetical Errors 32
56. Financial Evaluation 32
57. Price Comparison 33
58. Negotiations 34
59. Post-qualification 34
60. Procuring Entity's Right to Accept any or to Reject Any or All Tenders 34
61. Rejection of All Tenders 35
62. Informing Reasons for Rejection 35

G. Contract Award 35

63. Award Criteria 35
64. Notification of Award 35
65. Performance Security 36
66. Form and Time Limit for Furnishing of Performance Security 36
67. Validity of Performance Security 36
68. Authenticity of Performance Security 37
69. Contract Signing 37
70. Publication of Notification of Award of Contract 37
71. Debriefing of Tenderers 37
72. Adjudicator 37
73. Right to Complain 37

Section 2. Tender Data Sheet 38

A. General 38

B. Tender Document 38

C. Qualification Criteria 39

D. Tender Preparation 40

E. Tender Submission 42

F. Tender Opening and Evaluation 42

Only the Technically Responsive Tender will be considered for Financial Evaluation: 43

G. Contract Award 43

Section 3. General Conditions of Contract 44

A. General 44

1. Definitions 44
2. Interpretation 47
3. Communications and Notices 47
4. **Governing Law** 48

5. Governing Language 48
6. Documents Forming the Contract and Priority of Documents 48
7. Scope of Works 48
8. Assignment 48
9. Eligibility 48
10. Gratuities / Agency fees 49
11. Confidential Details 49
12. JVCA 49
13. Possession of the Site 49
14. Access to the Site 49
15. Procuring Entity's Responsibilities 49
16. Approval of the Contractor's Temporary Works 50
17. Contractor's Responsibilities 50
18. Taxes and Duties 50
19. Contractor's Personnel 50
20. Subcontracting 50
21. Nominated Subcontractor 50
22. Other Contractors 51
23. Project Manager's Decisions 51
24. Delegation 51
25. Instructions, 51
26. Queries about the Contract conditions 51
27. Safety, Security and Protection of the Environment 51
28. Working Hours 51
29. Welfare of Labourers 51
30. Child Labour 52
31. Discoveries 52
32. Procuring Entity's and Contractor's Risks 52
33. Procuring Entity's Risks 52
34. Contractor's Risks 52
35. Copyright 52
36. Limitation of Liability 53
37. Insurance 53
38. Management and Progress Meetings 53
39. Corrupt, Fraudulent, Collusive or Coercive Practices 54

B. Time Control 55
40. Commencement of Works 55
41. Completion of Works 55
42. Programme of Works 55
43. Pro Rata Progress 56
44. Early Warning 56
45. Extension of Intended Completion Date 56
46. Delays Caused by Authorities 56
47. Acceleration 57
48. Delays Ordered by the Project Manager 57
49. Suspension of Work 57
50. Consequences of Suspension 57

C. Quality Control 57
51. Execution of Works 57
52. Examination of Works before covering up 57
53. Identifying Defects 58
54. Testing 58
55. Rejection of Works 58
56. Remedial Work 58
57. Correction of Defects 58
58. Uncorrected Defects 58

D. Cost Control 59
59. Contract Price 59
60. Bill of Quantities 59
61. Changes in the Quantities and Unit Rate or Price 59
62. Variations 59
63. Costing of Variations or Extra Orders 59
64. Cash Flow Forecasts 60
65. Payment Certificates 60
66. Payments to the Contractor 60

67. **Delayed Payment** 60
68. **Payments to Nominated Subcontractor(s)** 60
69. **Compensation Events** 61
70. **Adjustments for Changes in Legislation** 62
71. **Price Adjustment** 62
72. **Retention Money** 62
73. **Liquidated Damages** 62
74. **Bonus** 63
75. **Advance Payment** 63
76. **Performance Security** 63
77. **Provisional Sums** 64
78. **Day works** 64
79. **Cost of Repairs to Loss or Damages** 64
80. **Completion** 64
81. **Taking Over** 64
82. **Amendment to Contract** 64
83. **Final Account** 65
84. **As-built Drawings and Manuals** 65
85. **Force Majeure** 65
86. **Notice of Force Majeure** 65
87. **Consequences of Force Majeure** 66
88. **Release from Performance** 66
89. **Termination** 66
90. **Payment upon Termination** 68
91. **Property** 68
92. **Frustration** 68
93. **Contractor's Claims** 69
94. **Settlement of Disputes** 69

Section 4: (Part-I) Particular Conditions of Contract.....71

SECTION 4: PART -III -(LABOUR LAWS) 76

Section 5. Tender and Contract Forms 77

Tender Submission Letter (Form PW3-1) 78
N/A 81
Financial (Price) Proposal Letter (Form PW3-1B) 81
[This letter should be completed and signed by the Authorised signatory preferably on the Letter-Head Pad of the Tenderer] 81
Tenderer Information (Form PW3-2) 83
JVCA Partner Information (Form PW3-3) 87
Subcontractor Information (Form PW3-4) 86
Personnel Information (Form PW3-5) 88
Bank Guarantee for Tender Security (Form PW3-6) 0
Notification of Award (Form PW3-7) 1
Contract Agreement (Form PW3-8) 2
Bank Guarantee for Performance Security (Form PW3-9) 3
Bank Guarantee for Advance Payment (Form PW3-10) 4
Bank Guarantee for Retention Money Security (Form PW3-11) 5

Section 6. Bil of Quantities

Volume 2 of 3

Section 7. General Technical Specification (Sec: 1--------19)

Volume 3 of 3

Section 8. Particular Specifications and Schedules

Section 9. Drawings (Vol 3 of 3).....

Section 1. Instructions to Tenderers

A. General

1. Scope of Tender

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

1.2 The successful Tenderer shall be required to execute the Works and physical services as specified in the General Conditions of Contract

2. Interpretation

2.1 Throughout this Tender Document:

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

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

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

(d) "Person" means and includes an individual, body of individuals, sole proprietorship, partnership, company, association or cooperative society that wishes to participate in Procurement proceedings;

(e) "Tenderer" meansa Person who submits a Tender;

(f) "Tender Document" means the Document provided by a Procuring Entity to a Tenderer as a basis for preparation of the Tender; and

(g) "Tender" depending on the context, means a Tender submitted by a Tenderer for execution of Works and physical services to a Procuring Entity in response to an Invitation for Tender.

3. Source of Funds

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

3.2 For the purpose of this provision, "public funds" means any monetary resources appropriated to the Procuring Entity under Government budget, or loan, grants and credits placed at the disposal of the Procuring Entity through the Government by the development partners or foreign states or organisations.

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 or foreign state or Organisation in accordance with the applicable Loan / Credit / Grant Agreement, and will be subject in all respects to the terms and conditions of that Agreement.

4. Corrupt, Fraudulent, Collusive,Coercive (or Obstructive in case of Development Partner) Practices	4.1	The Government and the Development Partner, if applicablerequires that the Procuring Entity as well as the Tenderersand 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 theirsub-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 specifried in the **TDS.**

6. Eligible Materials, Equipment and Associated Services

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

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

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

7. Site Visit

7.1 Tenderersare advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The costs of visiting the Site shall be at Tenderer’s own expense.

B. Tender Document

8. Tender Document: General

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

- Section 1 Instructions to Tenderers (ITT)
- Section 2 Tender Data Sheet (**TDS**)
- Section 3 General Conditions of Contract (GCC)
- Section 4 Particular Conditions of Contract (**PCC**)
- Section 5 Tender and Contract Forms
- Section 6 Bill of Quantities (**BOQ**)
- Section 7 General Specifications
- Section 8 Particular Specifications
- Section 9 Drawings

8.2 The Procuring Entity is not responsible for the completeness of the Tender Document and their addenda, if these were not purchased directly from the Procuring Entity, or through its agent as specified in the **TDS.**

8.3 Tenderersare expected to examine all instructions, forms, terms, and specifications in the Tender Document as well as in addendum to Tender, if any.

9. Clarification of Tender Document

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

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 Procuring Entity may, if stated in the **TDS**, hold a pre-Tender Meeting at the place, date and time as specified in the **TDS**. All potential Tenderers are encouraged and invited to attend the meeting, if it is held.

10.2 Tenderersare requested to submit any questions in writing so as to reach the Procuring Entity not later than one day prior to the date of the meeting.

10.3 Minutes of the pre-Tender meeting, including the text of the questions raised and the responses given, together with any responses prepared after the meeting, will be transmitted within five (5) working days after holding the meeting to all those who purchased the Tender document and to even those who did not attend the meeting. Any revision to the TenderDocument listed in ITTSub Clause 8.1 that may become necessary as a result of the pre-Tender meeting will be made by the Procuring Entity exclusivelythrough the issue of an Addendum pursuant to ITT Sub Clause 11 and not through the minutes of the pre-Tender meeting.

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

11. Addendum to Tender Document

11.1 At any time prior to the deadline for submission of Tenders, the Procuring Entity, on its own initiative or in response to an inquiry in writing from a Tenderer, having purchased the Tender Document, or as a result of a pre-Tender meeting may revise the Tender Document by issuing an Addendum.

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

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

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

11.5 If an addendum is issued when time remaining is less than **one-third**of the time allowed for the preparation of Tenders, the Procuring Entity at its discretion shall extend the deadline by an appropriate number of days for the submission of Tenders, depending upon the nature of the Procurement requirement and the addendum. In any case, the minimum time for such extension shall not be less than three (3) working days.

C. Qualification Criteria

12. General Criteria

12.1 TenderTenderers 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, which entails setting pass/fail criteria, which if not met by the Tenderers, will result in consideration of its Tender as non-responsive.

12.2 In addition to meeting the eligibility criteria, as stated in ITT Clause 5, Tenderers must satisfy the other criteria stated in ITT Clauses 13 to 18 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 Tenderers shall demonstrate having resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts. The requirement of general experience as stated under ITT

Sub Clause 14.1(a) and specific experience, unless otherwise of different nature, as stated under ITT Sub Clause 15.1(b) shall not be separately applicable for each individual lot.

13. Litigation History

13.1 Litigation history shall comply with the requirement as stated under ITT Sub Clause15.1(c).

14. Experience Criteria

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

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

(b) specific experience as a Prime Contractor or Subcontractor or Management Contractor in construction works of a nature, complexity and methods/construction technology similar to the proposed Works, in at least a number of contract(s)and, each with 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 to qualify for the performance of the Works under the Contract.

(a) the average annual **construction** turnover as specified in the **TDS** during the period specified in the **TDS;**

(b) availability of minimum liquid assets i.e working capital or credit facilities from any scheduledBank of Bangladesh, net of other contractual commitments, of the amount as specified in the **TDS**;

(c) satisfactory resolution of all claims under litigation cases and shall not have serious negative impact on the financial capacity of the Tenderers. All pending litigation shall be treated as resolved against the Tenderers; and

(d) The Minimum Tender Capacity as specified in the TDS.

16. Personnel Capacity

16.1 Tenderers shall have the following minimum level of personnel capacity to qualify for the performance of the Works under the Contract consisting of a Construction Project Manager, Engineers, and other key staff with qualifications and experience as specified in the **TDS.**

17. Equipment Capacity

17.1 Tenderers 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 (JV)

18.1 Tenderers may participate in the procurement proceedings forming a Joint Venture(JV) by an agreement, executed case by case on a non judicial stamp of value as specified in the**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 legally authorised partners of the intended JV and authenticated by a Notary Public, with the declaration that the partners will execute the JV agreement in the event the Tenderer is successful.

18.2 The figures for each of the partners of a JV shall be added together to determine the Tenderer's compliance with the minimum qualifying criteria; however, for a JV under ITT Sub Clause 18.1, with number of partners as specified in the **TDS** to qualify, Leading partner and other partners must meet the criteria as specified in the **TDS.** Failure to comply with these requirements will result in non-responsiveness of the JV Tender.

18.3 Each partner of the JV 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 JV shall nominate the **Leading Partner**as**RPRESENTATIVE**being entrusted with the Contract administration and management at Site who shall have the authority to conduct all business for and on behalf of any and all the partners of the JV during the Tendering process and, in the event the JV is awarded the Contract, during contract execution including the receipt of payments for and on behalf of the JV.

19. Subcontractor(s)

19.1 Tenderers may intend to subcontract an activity or part of the Works, in which case such elements and the proposed Subcontractor shall be clearly identified.

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

19.3 A Subcontractor may participate in more than one Tender, but only in that capacity.

19.4 The Procuring Entity may also select in advance 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 Works or any part of it to a Subcontractor.

D. Tender Preparation

20. Only one Tender

20.1 Tenderers shall submit only one (1) Tender for each lot, either individually or as a JV. Tenderer who submits or participates in more than one (1) Tender in one (1) lot of a package or in one (1) package withone (1) lot will cause all the Tenders of that particular Tenderer 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 Procuring Entity shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Tendering process.

22. Issuance and Sale of Tender Document

22.1 The Procuring Entity shall make Tender Documents available immediately to the potential Tenderers, requesting and willing to purchase at the corresponding price by the date the advertisement has been published in the newspaper.

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

23. Language of Tender

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

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

24. Contents of Tender

24.1 The Tender prepared by the Tendererswill comprise the following:

(a) the Tender Submission Letter(**Form PW3-1**), as stated under ITT Sub Clause 25.1;

(b) the Tenderer Informationas stated under ITT Clauses 5,29 and 32 (**Form PW3-2**);

(c) the priced BOQ for each lot in accordance with ITT Clauses 25,27and 28;

(d) the Tender Securityas stated under ITT Clauses 35, 36 and 37.

(e) the alternatives, if permissible, as stated under ITT Clause 26;

(f) the written confirmation authorizing the signatory of the Tender to commit the Tenderer, as stated under ITT Sub Clause 40.3;

(g) the Valid Trade license ;

(h) documentary evidence of Tax Identification Number (TIN) and Value Added Tax (VAT) as a proof of taxation obligations as stated under ITT Sub Clause 5.5;

(i) the Technical Proposal describing work plan & method, personnel, equipment and schedules as stated under ITT Clause 31;

(j) documentary evidence as stated under ITT Clause 29 and 32 establishing the Tenderer's eligibility and the minimum qualifications of the Tenderers required to be met for due performance of the Works and physical services under the Contract;

(k) document establishing legal and financial autonomy and compliance with commercial law, as stated under ITT Sub Clause5.10 in case of government owned entity;

(l) documentary evidence for past performance evaluation and rating matrix as stated under ITT Sub Clause 50.2; and

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

25. Tender Submission Letter and Bill of Quantities

25.1 Tenderers shall submit the Tender Submission Letter (**Form PW3-1**), which shall be completed without any alterations to its format, filling in all blank spaces with the information requested, failing which the Tender may be rejected as being incomplete.

25.2 Tenderers shall submit the priced BOQ using the form(s) furnished in **Section 6: Bill of Quantities.**

25.3 If in preparing its Tender, the Tenderer has made errors in the unit rate or the total price, and wishes to correct such errors prior to submission of its Tender, it may do so, but shall ensure that each correction is initialled by the authorised person of the Tenderer.

26. Alternatives

26.1 Unless otherwise specified in the **TDS**, alternative technical solutions shall not be considered.

26.2 When specified in ITT clause 26.1, Tenderers are permitted to submit alternative technical solutions for specified parts of the Works, and such parts will be identified in the **TDS.**

26.3 Only the technical alternatives, if any, of the lowest evaluated Tenderer conforming to the basic technical requirements will be considered by the Procuring Entity.

27. Tender Prices, Discounts and Price Adjustment

27.1 The prices and discounts quoted by the Tenderers in the Tender Submission Letter (**Form PW3-1**) and in the BOQ shall conform to the requirements specified below.

27.2 Tenderers shall fill in unit rates for all items of the Works both in figures and in words as described in the BOQ, excluding any discount offered.

27.3 The items quantified in the BOQ for which no unit rates have been quoted by the Tenderer will not be paid for, by the Procuring Entity when executed and shall be deemed covered by the amounts of other rates in the BOQ and, it shall not be a reason to change the Tender price.

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

27.5 Tenderers shall quote any unconditional discounts in the Tender Submission Letter as stated under ITT Sub Clause 25.1.

27.6 Tenderers wishing to offer any unconditional discount to any package or lot as applicable shall mention discount in percentage (%) in the Tender Submission Letter. Discount shall be equally applicable on all the items of BOQ and shall be applied after arithmetic correction of the tender.

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

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

27.9 If so stated under ITT Sub Clause 27.9, Tenders are being invited with a provision for price adjustments. The unit rates quoted by the Tenderers are subject to adjustment during the performance of the Contract in accordance with the provisions of General Condition of Contract (GCC) Clause 69 and, in such case the Procuring Entity shall provide the indexes and weightings or coefficients in **Appendix to the Tender (Table 1.1 and Table 1.2)** for the price adjustment formulae as specified in the Particular Conditions of Contract (**PCC**).

28. Tender Currency

28.1 Tenderers shall quote all prices in the Tender Submission Letter and in the BOQ in Bangladesh Taka (BDT) currency.

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 PW3-1**);

(b) complete the Tenderer Information (**Form PW3-2**);

(c) complete Subcontractor Information (**Form PW3-4**), 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 underITT Sub Clause 29.1, it shall:

(a) provide for each JV partner, completed JV Partner Information (**Form PW3-3**);

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

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

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

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

31. Documents Establishing Technical Proposal

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

32. Documents Establishing the Tenderer's Qualification

32.1 Tenderers shall complete and submit the Tenderer Information (**Form PW3-2/PW3-3**) and shall include documentary evidence, as applicable to satisfy the following:

(a) general experience, oftheentity(s) participating in the Tender, in construction works as stated under ITT Sub Clause 14.1(a), substantiated by the year of registration/constitution/licensing in its country of origin;

(b) specific experience, oftheentity(s) participating in the Tender, in construction works under public sector of similar nature and size as stated under ITT Sub Clause 14.1(b), substantiated by Completion Certificate (s) issued by the relevant Procuring Entity(s);

(c) average annual **construction** turnover i.e total certified payments received for contracts in progress or completed under public sector for a period as stated under ITT Sub Clause 15.1(a), substantiatedby Statement(s) of Receipts, from any scheduled Bank of Bangladesh, issued not earlier than twenty-eight (28) days prior to the day of the original deadline for submission of Tenders;

(d) adequacy of minimum liquid assets i.e working capital substantiated by Audit Reports mentioned in (i) belowor credit line(s) substantiated by any scheduled Bank of Bangladesh in the format as specified (**Form PW3-7**),

without alteration,issued not earlier than twenty-eight (28) days prior to the day of the original deadline for submission of Tenders for this Contract as stated under ITT Sub Clause 15.1(b);

(e) information regarding claims under litigation, current or during the last years as specified in the **TDS**, in which the Tenderer is involved, the parties concerned, and value of claim as stated under ITT Sub Clause 15.1(c), substantiated by statement(s) of the entity(s) participating in the Tender in its letter-head pad;

(f) technical and administrative personnel along with their qualification and experience proposed for the Contract as stated under ITT Clause 16;

(g) major items of construction equipment proposed to carry out the Contract as stated under ITT Clause 17, substantiated by statement(s) of the entity(s) participating in the Tender in its letter-head pad declaring source of its availability;

(h) authority(s), to seek references from the Tenderer'sBankers or any other sources, of the entity(s) participating in the Tender in its letter-head pad;

(i) reports on the financial standing of the Tenderer, such as profit and loss statements and audited balance sheet for the past years as specified in the **TDS**, of the entity(s) participating in the Tender, substantiated by Audit Reports.

33. Validity Period of Tender

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

34. Extension of Tender Validity and Tender Security

34.1 In exceptional circumstances, prior to the expiration of the Tender Validity period, the Procuring Entity may solicit all the Tenderers' consent to an extension of the period of validity of their Tenders; provided that those Tenderers have passed the preliminary examination as stated under ITT Sub Clause 51.3.

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

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

35. Tender Security

35.1 Tenderers shall furnish as part of its Tender, in favour of the Procuring Entity or as otherwise directed on account of the Tenderer, a Tender Security in original form (not copy) and in the amount, as specified in the **TDS**.

35.2 If the Tender is a Joint Venture, the Tenderer shall furnish as part of its Tender, in favour of the Procuring Entity or as

otherwise directed on account of the title of the existing or intended JV or any of the partners of that JV or in the names of all future partners as named in the Letter of Intent of the JV, a Tender Security in original form and in the amount as stated under ITT Sub Clause 35.1.

35.3 In case of substitution of the Tender as stated under ITT Clause 46 a new Tender Security shall be required in the substituted Tender.

36. Form of Tender Security

36.1 The Tender Security shall:

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

i. in the form of a Bank Draft or Pay Order, or

ii. in the form of an irrevocable unconditional Bank Guarantee issued by any scheduled Bank of Bangladesh, in the format (**Form PW3-6**),without any alteration, furnished in **Section 5: Tender and Contract Forms**;

(b) be payable promptly upon written demand by the Procuring Entity in the case of the conditions as stated under ITT Sub Clause 39.1 being invoked; and

(c) remain valid for at least twenty-eight (28) days beyond the expiry date of the Tender Validity in order to make a claim in due course against a Tenderer in the circumstances as stated under ITT Sub Clause 39.1.

37. Authenticity of Tender Security

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

37.2 If a Tender Security is found to be not authentic, the Procuring Entity may proceed to take measures against that Tenderer as stated under ITT Sub Clause 4.4.

37.3 A Tender not accompanied by a valid Tender Security willbe considered non-responsive.

38. Return of Tender Security

38.1 No Tender Security shall be returned to the Tenderers before contract signing.

38.2 Unsuccessful Tenderer's Tender Security will be discharged or returned as soon as possible but within twenty-eight (28) days after the expiry of the Tender Validity period as stated under ITT Sub Clauses 33.1.

38.3 The Tender Security of the successful Tenderer will be discharged upon the Tenderer's furnishing of the performance security and signing of the Contract Agreement.

39. Forfeiture of Tender Security

39.1 The Tender Securitymay be forfeited, if a Tenderer:

(a) withdraws its Tender after opening of Tenders but within the validity of the Tender as stated under ITT Clause 33 and 34; or

(b) refuses to accept a Notification of Award as stated under ITTSub Clause 64.3; or

(c) fails to furnish Performance Security as stated under ITTSub Clause 65.1 and 65.2; or

(d) refuses to sign the Contract as stated under ITTSub Clause 70.2; or

(e) does not accept the correction of the Tender pricefollowing the correction of the arithmetic errors as stated under ITT Clause 55.

40. Format and Signing of Tender

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

40.2 Alternatives, if permitted as stated under ITT Clause 26, shall be clearly marked "Alternative".

40.3 The original and each copy of the Tender shall be typed or written in indelible ink and shall be signed by the Person duly authorized to sign on behalf of the Tenderer. This Tender specific authorization shall be attached to the Tender Submission Letter (**Form PW3-1**). The name and position held by each Person(s) signing the authorization must be typed or printed below the signature. All pages of the original and of each copy of the Tender, except for un-amended printed literature, shall be numbered sequentially and signed by the person signing the Tender.

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

E. Tender Submission

41. Sealing, Marking and Submission of Tender

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

41.2 The inner and outer envelopes shall:

(a) be addressed to the Procuring Entity at the address as stated under ITT Sub Clause 42.1;

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

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

(d) bear a statement "DO NOT OPEN BEFORE ----------"

the time and date for Tender opening as stated under ITT Sub Clause 48.1;

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

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

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

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

42. Deadline for Submission of Tender

42.1 Tenders shall be delivered to the Procuring Entity at the address specified in the **TDS** and not later than the date and time specified in the **TDS.**

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

42.3 If submission of Tendersis 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.**

42.4 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 42.1, 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 42.3, as specified in the **TDS**.

43. LateTender

43.1 Any Tender received by the Procuring Entity after the deadline for submission of Tenders as stated underITT Sub Clause 42.1shall be declared LATEand returned unopened to the Tenderer.

44. Modification, Substitution or Withdrawal of Tender

44.1 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 Tendersas stated underITT Clause 42.

45. Tender Modification

45.1 Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit corresponding modification to its original Tender marked as "**MODIFICATION (M)".**

46. Tender Substitution

46.1 Tenderers shall not be allowed to retrieve its original Tender, but shall be allowed to submit another Tender

marked as **"SUBSTITUTION (S)".**

47. Tender Withdrawal

47.1 Tenderers shall be allowed to withdraw its Tender by a Letter of Withdrawal marked as **"WITHDRAWAL(W)".**

F. Tender Opening and Evaluation

48. Tender Opening

48.1 Tenders 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 48.2.

48.2 If submission of Tendersis allowed in more than one location as stated under ITT Sub Clause 42.3 and 42.4, Tenders shall be opened, immediately after receipt of Tenders from all the secondary place(s), at the primary place at the date and time as stated under ITT Sub Clause 48.1.

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

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

48.5 The authenticity of withdrawal or substitution of, or modifications to original Tender, if any made by a Tenderer in specified manner, shall be examined and verified by the Tender Opening Committee (TOC) based on documents submitted as stated under ITT Sub Clause 44.1.

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

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

(i) the name and address of the Tenderer;

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

(iii) the Tender price;

(iv) the official cost estimate;

(v) any discounts;

(vi) any alternatives;

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

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

(b) only discounts and alternatives read aloud at the Tender opening willbe considered in evaluation.

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

48.7 Upon completion of Tender opening, all members of the TOC and the Tenderers or Tenderer's duly authorised representatives attending the Tender 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.

48.8 The omission of a Tenderer's signature on the record shall not invalidate the contents and effect of the record under ITT Sub Clause 48.6.

48.9 No Tender willbe rejected at the Tender opening stage except the LATE Tenders as stated in the ITT Clause 43.

49. Evaluation of Tenders

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

49.2 **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.

49.3 **Tenderers having quoted the tender price more than 10 (Ten) percent above or below the official cost estimate, the tender will be rejected.**

50. Evaluation Process

50.1 TEC may consider a Tender 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 Tender opening following four steps:

(a) Preliminary examination

(b) Technical examination and responsiveness

(c) Financial evaluation and price comparison

(d) Post-qualification of the Tender.

50.2 In case of tie for the evaluated price, the tenderer shall be selected based on the "Past Performance Evaluation and rating matrix for different aspects" to be used in assessing the Tenderer's quality as stated below:

Past Performance Evaluation and rating matrix for different aspects

Sl. No	Aspects of Evaluation	Measure of Rating	Past Performance Rating					Points Awarded
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	Number of court cases filed and won against PEs during last 5 years **(a) Cases filed**	No. of Court Cases	≥ 5 nos	< 5 but ≥ 3 nos	< 3 but ≥ 1 no	≤ 1 no	none	
	Points Allocated		0	25	50	75	**100**	
	Points Awarded							
	(b) Cases won	No. of Court Cases	None	≤ 1 nos	< 3 but ≥ 1 nos	< 5 but ≥ 3 nos	≥ 5 nos	
	Points Allocated		0	25	50	75	**100**	
	Points Awarded							
	For no Case filed and no Case won, the Points Awarded shall be taken as 200						-	
2	Debarred by PEs during last 5 years	No. of Years	≥ 5 yrs	< 5 but ≥ 3 yrs	< 3 but ≥ 1 yrs	≤ 1 yrs	none	
	Points Allocated		0	25	50	75	**100**	
	Points Awarded							
3	Termination of incomplete contract for poor performance by PEs during last 5 years	No. of Contracts	≥ 5 contract	< 5 but ≥ 3 contract	< 3 but ≥ 1 contract	≤ 1 contract	none	
	Points Allocated		0	50	75	100	**150**	
	Points Awarded							
4	Extension of Time beyond original contract period by PEs during last 5 years	Percent Time of Contract	≥ 50 % of contract period	< 50% but ≥ 30% of contract period	< 30% but ≥ 10% of contract period	≤ 10% of contract period	none	
	Points Allocated		0	50	75	100	**150**	
	Points Awarded							
5	Imposition of Liquidity Damages (LD) by PEs during last 5 years	Percent Time of Contract	≥ 50 % of contract period	< 50% but ≥ 30% of contract period	< 30% but ≥ 10% of contract period	≤ 10% of contract period	none	
	Points Allocated		0	50	75	100	**150**	
	Points Awarded							
6	Extension of contracted Defects Liability Period (DLP) by PEs during last 5 years	Percent Time of Contract	≥ 50 % of DLP	< 50% but ≥ 30% of DLP	< 30% but ≥ 10% of DLP	≤ 10% of DLP	none	
	Points Allocated		0	50	75	100	**150**	
	Points Awarded							
7	Declared bankrupt during last 5 years	Year Counting Backward	Year 2	Year 3	Year 4	Year 5	none	
	Points Allocated		0	25	50	75	**100**	
	Points Awarded							
	Total Points Allocated						**1000**	-
	Total Points Awarded (Col.9)						-	

In case of multiple EQUALs in their Past Performance, total Turnover of last five (5) years shall determine the ranking.

51. Preliminary Examination

51.2 TEC shall examine the Tenders to confirm that all documentation as stated under ITT Clause 24 has been provided, to determine the completeness of each document submitted.

51.3 TEC shall confirm that the following documents and information have been provided in the Tender. If any of these documents or information is missing, the Tender shall be considered rejected.

(a) Tender Submission Letter;

(b) Priced Bill of Quantities;

(c) Written confirmation authorizing the signatory of the Tender to commit the Tenderer; and

(d) Valid Tender Security.

52. Technical Responsiveness and Technical Evaluation

52.1 TEC's determination of a Tender's responsiveness is to be based on the contents of the Tender itself without recourse to extrinsic evidence.

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

(a) affects in any substantial way the scope, quality, or performance of the Works and physical services specified in the Contract; or

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

(c) if rectified would unfairly affect the competitive position of other Tenderers presenting responsive Tenders.

During the evaluation of Tenders, the following definitions shall apply:

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

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

"Omission" is the failure to submit part or all of the information or documentation required in the Tender Document.

52.3 If a Tender is not responsive to the mandatory requirements set out in the Tender Document, shall not subsequently be made responsive by the Tenderer by correction of the material deviation, reservation, or omission.

52.4 There shall be no requirement as to the minimum number

of responsive Tenders.

52.5 There shall be no automatic exclusion of Tenders which are above or below the official estimate except ITT sub-Clause 49.3.

52.6 TEC shall evaluate the aspects of the Tender submitted as stated under ITT Clauses 29, 30,31 and 32 and, to confirm

that all requirements specified in Section 7: General Specifications and Section 8: Particular Specifications of the Tender Document have been met without any material deviation, reservation or omission.

52.7 Provided that a Tender is responsive, TEC may request that the Tenderer submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities or omissions in the Tender related to documentation requirements. Such omission shall not be related to any aspect of the rates of the Tender reflected in the Priced BOQ or any mandatory criteria. Failure of the Tenderer to comply with the request may result in the consideration of its Tender as non-responsive.

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

(a) minor or insignificant deviations which do not meaningfully alter or depart from the technical specifications, characteristics and commercial terms and, conditions or other mandatory requirements set out in the Tender Document; or

(b) errors or oversights, that if corrected, would not alter the key aspects of the Tender.

53. Clarification on Tender

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

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

53.3 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 Tender.

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

54. Restrictions on Disclosure of Information

54.1 Following the opening of Tenders 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

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

54.3 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.

54.4 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.

55. Correction of Arithmetical Errors

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

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

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

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

55.2 TEC shall correct the arithmetic errors and shall promptly notify the concerned Tenderer(s).If the Tendererdoes not accept the correction of arithmetic errors, its Tender shall be rejected.

56. Financial Evaluation

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

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

(a) the Tender price, excluding Provisional Sums and the provision, if any, for contingencies in the priced BOQ, but including Daywork items ;

(b) adjustments for correction of arithmetical errors,as stated under ITT Sub Clause 55.1;

(c) adjustments in order to take into consideration the unconditional discountsas stated underITT Sub Clause 27.5 and 27.6, if any..

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

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

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

56.6 To determine the lowest-evaluated lot/package the TEC will take into account:

(a) the lowest-evaluated Tender for each lot;

(b) the resources sufficient to meet the qualifying criteria for the individual lot or aggregate of the qualifying criteria forthe multiple lots;

(c) the price reduction on account of discount per lot/package as offered by the Tenderer in its Tender; and

(d) the Contract-award sequence that provides the optimum economic combination on the basis of least overall cost of the total Contract package taking into account any limitations due to constraints in Works or execution capacity determined in accordance with the tender capacity as stated in ITT Sub Clause 15.1 (d) and post-qualification criteria as stated under ITT Clause 59.

56.7 TEC may recommend to increase the amount of the Performance Security above the amounts as stated under ITT Sub Clause 65.1 but not exceeding twenty-five (25) percent of the Contract Price, if in the opinion of TEC, it is found that the Tender is significantly below the updated official estimated cost or unbalanced as a result of front loading.

57. Price Comparison

57.1 TEC shall compare all responsive Tenders to determine the lowest-evaluated Tender, as stated under ITT Clause 56.

57.2 In the extremely unlikely event that there is a tie for the lowest evaluated price, the Tenderer with the superior past performance as stated in ITT sub-clause 50.2 shall be selected.

57.3 In the event that there is a tie for the lowest price and none of the Tenderers has the record of past performance with the Procuring Entity as stated under ITT Sub Clause 57.2, then the Tenderer shall be selected, subject to firm

confirmation through the Post-qualification process, after consideration as to whether the Tenderer has demonstrated in its Tender superior past performance with the other Procuring Entities or a more efficient work programme and work methodology.

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

58. Negotiations

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

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

58.3 If the Procuring Entity decides to negotiate for reducing the scope of the requirements under ITT Sub Clause 58.2, it will be required to guarantee that the lowest Tenderer remains the lowest Tenderer even after the scope of work has been revised and shall further be ensured that the objective of the Procurement will not be seriously affected through this reduction.

58.4 In the event that the Procuring Entity decides because of a high Tender priceto 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.

59. Post-qualification

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

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

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

60. Procuring Entity's Right to Accept any or to Reject Any or All Tenders

60.1 The Procuring Entity reserves the right to accept any Tender or to reject any or all theTenders any time prior to contract award and , to annul the Procurement proceedings with prior approval of the Head of the Procuring Entity, any time prior to the deadline for submission of Tenders following specified procedures, without thereby incurring any liability to Tenderers, or any obligations to inform the Tenderers of the grounds for the Procuring Entity's action.

61. Rejection of All Tenders

a. The Procuring Entity may, in the circumstances as stated under ITT Sub Clause61.2 reject all Tenders following recommendations from the TEC only after the approval of such recommendations by the Head of the Procuring Entity.

b. All Tenders can be rejected, if -

i. the price of the lowest evaluated Tender exceeds the official estimated cost, provided the estimate is realistic, subject to ITT Sub Clause 58.2 ; or

ii. there is evidence of lack of effective competition; such as non-participation by a number of potential Tenderers; or

iii. the Tenderers are unable to propose completion of the contract within the stipulated time in its Tender, though the stipulated time is reasonable and realistic; or

iv. all Tenders are non-responsive; or

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

c. 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.

62. Informing Reasons for Rejection

62.1 Notice of the rejection will be given promptly within seven (7) working days of decision taken by the Procuring Entity to all Tenderers and, the Procuring Entity will, upon receipt of a written request, communicate to any Tenderer the reason(s) for its rejection but is not required to justify those reason(s).

G. Contract Award

63. Award Criteria

63.1 The Procuring Entity shall award the Contract to the Tenderer whose Tenderis responsive to all the requirements of the Tender Document and that has been determined to be the lowest evaluated Tender, provided further that the Tenderer is determined to be Post-qualified in accordance with ITT Clouse 59.

63.2 Tenderer will not be required, as a condition for award, to undertake responsibilities not stipulated in the TenderDocuments, 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 one (1) week of receipt of the approval of the award by the Approving Authority, the Procuring Entity shall issue the Notification of Award (NOA) to the successful Tenderer.

64.2 The NOA, attaching the contract as per the sample (**Form PW3-8**) to be signed, shall state :

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

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

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

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

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

64.3 The NOA shall be accepted by the successful Tenderer within seven (7) working days from the date of its issuance.

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

65. Performance Security

65.1 Performance Security shall be provided by the successful Tenderer in BDT currency, of the amount as specified in the **TDS**.

65.2 The Procuring Entity shall increase the amount of the Performance Security on the recommendation of TEC above the amounts as stated under ITT Sub Clause 56.7.

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

65.4 In the event a Government owned enterprise as stated under ITT Sub Clause 5.10 is the successful Tenderer, Performance Security, as stated under ITT Sub Clause 65.1, shall not be required and, in lieu, there shall be Retention Money as specified in the **TDS.**

66. Form and Time Limit for Furnishing of Performance Security

66.1 Performance Security, as stated under ITT Clause 65, may be in the form of a Bank Draft, Pay Order or an irrevocable unconditional Bank Guarantee in the format (**Form PW3-10**), without any alteration, issued by any scheduled Bank of Bangladesh acceptable to the Procuring Entity.

66.2 Within fourteen (14) days from the date of acceptance of the NOA but not later than the date specified therein, the successful Tenderer shall furnish the Performance Security for the due performance of the Contract in the amount as stated under ITT Sub Clauses 65.1 or 65.2.

67. Validity of Performance Security

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

68. Authenticity of Performance Security

68.1 The Procuring Entity 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 the Pay Order, Bank Draft or irrevocable unconditional Bank Guarantee in specified format.

69. Contract Signing

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

69.2 Within twenty–eight (28) days of the issuance of the NOA, the successful Tenderer and the Procuring Entity shall sign the contract. In the event the successful Tenderer is a JV, all partners of that JV must sign.

69.3 Failure of the successful Tenderer to submit the Performance Security, as stated under ITT Sub Clause 65.1, or to sign the Contract, as stated under ITT Sub Clause69.2, shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security. In that event the Procuring Entity may award the Contract to the next lowest evaluated responsiveTenderer, who is determined by the TEC to be qualified to perform the Contract satisfactorily.

70. Publication of Notification of Award of Contract

70.1The NOA for Contract shall be notified by the Procuring Entity to the Central Procurement Technical Unit within seven (**7**) days of its issuance for publication in their website, and that notice shall be kept posted for not less than a month.

71. Debriefing of Tenderers

71.1 Debriefing of Tenderers by the Procuring Entity shall outline the relative status and weakness only of his or her Tender requesting to be informed of the grounds for not accepting the Tender submitted by him or her, without disclosing information about any other Tenderer.

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

72. Adjudicator

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

73. Right to Complain

73.1 Tenderer has the right to complain in accordance with the Public Procurement Act 2006 and the Public Procurement Rules, 2008.

Section 2. Tender Data Sheet

Instructions for completing Tender Data Sheet are provided in italics in parenthesis for the relevant ITT clauses	
ITT Clause	**Amendments of, and Supplements to, Clauses in the Instructions to Tenderers**
A. General	
ITT 1.1	The Procuring Entity is Bangladesh Rural Electrification Board (BREB) represented by the **Superintending Engineer (Grid & Sub-Station),** Bangladesh Rural Electrification Board.
	The Name of the Tender is: **TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.** Brief Description of the Works: **TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.** Tender Ref : 27.12.2637.125.31.154.17.555 Date: 30 - 11 -2017 Package: **SE(G&SS)-33KVBB-BagerhatGr-01**
ITT 3.1	The source of fund : Bagerhat PBS Fund
ITT 3.3	The name of the Development Partner is **none**
ITT 5.1	Tenderers from the following countries are not eligible **Israel.**
ITT 6.1	Materials, Equipments and associated services from the following countries are not eligible: **Israel**
B. Tender Document	
ITT 8.2	The following are authorised agents of the Procuring Entity for the purpose of issuing the Tender Document: **None.** Agent's Name: Address: Telephone No.: Fax No.: e-mail address:
ITT 9.1	For **clarification of Tender Document purposes** only, the Procuring Entity's address is: Attention: **Superintending Engineer (Grid & Sub-Station)**,Bangladesh Rural Electrification Board Address: **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com** And contact Procuring Entity within **15 days.**

ITT 10.1	A Pre-Tender meeting shall be held as stated in Tender Notice under **Superintending Engineer (Grid & Sub-Station), Bangladesh Rural Electrification Board** Address: **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com** Time & Date: 11:00 AM on 14 - 12 -2017

C. Qualification Criteria

ITT 14.1(a)	**General Experience:** The minimum number of general experience of the Tenderer in the construction works/supply of goods and related service as Prime Contractor or Sub-contractor or a Management Contractor shall be 5 (five) years.
ITT 14.1(b)	i) **Specific experience:** In the case of single entity the minimum specific experience as a Prime Contractor or Subcontractor or Management Contractor in construction works at least 1(one) contract(s) of 33KV Switching Station or 132/33KV Sub Station or 33/11 KV Indoor Sub-station successfully completed within the last 05 years, each with a value of at least **BDT 115.19 Lakh.** ii) Joint venture, Consortium or Association (JVCA) may be made by 01(one) supply contractor and 01(one) construction contractor. In that case, the leading partner must have successfully completed at least 01 (one) contract of 33KV Switching Station or 132/33KV Sub Station or 33/11 KV Indoor Sub-station within the last 05(five) years each with a value of at least **BDT 115 .19 Lakh.**
ITT 15.1(a)	Average Annual Turnover of the last three (3) years: **Tk 767.94 Lakh.**
ITT 15.1(b)	The minimum amount of liquid assets of the last three (3) years: **Tk 191.98 Lakh**
ITT 16.1(a),	Required Construction Project Manager, Site Engineer, and other key staff for the construction work shall have the following qualifications and experience:

No	Position	Total Working Experience (overall years)	In Similar Working Experience (years)
1.	Project Manager (B.Sc. Engineer) (Electrical / Mechanical)- (1/1 no)	**10** Years	**05** Years.
2.	Site Engineer (B.Sc. / Diploma Engr.) (Electrical / Mechanical)- (2/2 nos)	**5/10** Years.	**03** Years.
3.	Site Engineer (B.Sc./Diploma Engr.) (Civil)- 2 (Two)nos.	**5/10** Years.	**03** Years.
4.	Site Supervisor, Foreman, Lineman for line construction/augmentation works (4 nos)	**05** Years	**03** Years.

The Number of key staffs mentioned above may be required to increase according to the site condition.

ITT 17.1	**The tenderer shall submit list of tools & equipment owned by them or have to submit evidence that they own or letter of authorization that they are assured to hire the required equipment, so that they could engage the equipment from the day of starting of the work to ensure the completion of the Project within the specified completion time with the technical proposal.**

ITT 18.1	**The value of non-judicial stamp for execution of the Joint Venture agreement shall be Tk 300 (Three Hundred).**
ITT 18.2	The **minimum qualification** requirements of Leading Partner and other Partner(s) of a JVCA 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

ITT 19.3	The Nominated Subcontractor(s) named [insert name(s)] shall execute the following specific components of the proposed Works: **Not Applicable**

D. Tender Preparation

ITT 24.1/ (24.1.A), (24.1.B), **(k)**	The Tenderer shall submit the following additional documents furnished below with its Technical Proposal: 1. Tenderers shall furnish copies of ISO 9001/9002 or equivalent certificates of proposed manufacturers for individual equipment, supply record of at least ten (10) years of equipment of the proposed manufacturers as on the date of tender opening and evidence from users satisfactory service mentioned above. The said equipment shall be in satisfactory service in humid tropical climate for a minimum of three (3) years 2. The tenderer shall submit satisfactory type test certificates of all the equipment to be supplied under this contract. 3.The Tender/manufacturer shall submit with its Tender the following additional documents: All necessary papers, test report, samples, catalogue etc as described in the technical specification of the Tender document. 4. The tender shall submit along with offer all type & routine test reports of offered equipment as mentioned in the specification enclosed in the tender document from internationally recognized independent testing laboratory such as KEMA HOLLAND, CESI-ITALLY, Under writers Laboratory (UL), U.S.A. CPRI-INDIA or equivalent laboratory for the equipment to be offered. For the test reports from the laboratories other than KEMA, CESI, UL-USA or CPRI, INDIA the tenderer must furnish evidence in support of the status of the laboratories, which should be acceptable to BREB. The Manufacturer's own test report will not be accepted. 5. i. Technical specification and brochures of equipment/plant to be incorporated in the works ii. Letter of authorization to the effect that the Tenderer is authorized to submit Tender on behalf of the respective manufacturers and the Tenderer has the authority to supply equipment to the Employer from the proposed manufacturers for 33 kV Circuit Breakers (VCB), 11kV Indoor Breaker, Disconnecting Switches (DS), 33 kV Current Transformers (CT), 33 kV Voltage Transformers (VT), Surge Arrestors, Power Cables, Protective Relays, Insulators and hardware fittings for conductors, earthwires and insulators. iii. Supply records of the manufacturer of 33 kV Circuit Breakers, 33 kV CT, PT, Surge Arrestors, Protective Relays, Insulators for the last ten (10) years. 6. Performance certificates of the above equipment 7. Tender Capacity / Bank solvency certificate from their banker showing capability of

	handling the projects. 8. Table of contents with page no. 9. Tender purchased receipt/Document. 10. Power of attorney in favour of the tender signatory. 11. A written confirmation of Authorization to sign on behave of the tenderer. 12. Statement of works in hand to be completed next 01(one) year including its value of uncompleted portion.
ITT 26.1	Alternative Tender shall not be considered.
ITT 26.2	There shall not be alternative times for completion of the Works.
ITT 26.4	Alternative technical solutions for any parts of works shall not be permitted.
ITT 27.09	The prices quoted by the Tenderer shall be **fixed** for the duration of the Contract.
ITT 28.1	The currency of the Tender shall be: **Bangladeshi Taka (BDT).**
ITT 31.1	The required Technical Proposal shall include the following additional information : I. Work plan II. Statement of working method III. Technical specification and brochures of machineries plant to be incorporated in the works. IV. Methodology of foundation, erection and stringing. V. Time Schedule in bar chart. VI. Organogram of the required man power for implementing of this project. VII. Letter of authorization to the effect that the Tendered is authorized to submit the Tender on behalf of the respective manufacturer and that the Tendered has the authority to supply such equipment to the employer from the proposed manufacturers for construction of switching station. VIII. Supply record of the manufacturer of the Equipments for switching station described in BOQ. IX. A certificate from end user that the said Switching Station are in service satisfactorily for minimum three (3) years. The certificate shall be in a letter head pad mentioning fax, e-mail, telephone number of contact person. The same will preferable for related items also like Equipments described in BOQ. X. Electrical and Mechanical type test certificates shall be from an independent reputed Testing Laboratory for the Equipments described in BOQ. XI. ISO 9001/9002 -2008 or equivalent certificates of proposed manufactures for individual Equipments described in BOQ XII. Design documents as per **Schedule -I** of the Tender Document. XIII. Personnel required for the work. XIV. Equipments required for the work.
ITT 33.1	The Tender Validity period shall be 120 days.
ITT 35.1	**The amount of the Tender Security** shall be **Tk 11.00 Lakh** (BDT: Eleven Lakh) in favour of BANGLADESH RURAL ELECTRIFICATION BOARD.
ITT 40.1	In addition to the original of the Technical proposal, 02(Two) copies of the Technical proposal shall be submitted. In addition to the original of the Financial proposal, 02(Two) copies of the Financial proposal shall be submitted.

E. Tender Submission	
ITT 42.1	For Tender submission purposes only, the Procuring Entity's address is: Attention: **Superintending Engineer (Grid & Sub-Station), Bangladesh Rural Electrification Board** Address: **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com** The deadline for the submission of Tenders is: Time & Date: **04 - 01 -2018 up to 12:00 noon (BST),**
ITT 41.2(e)	The inner and outer envelopes shall bear the following additional identification marks: **The inner and outer envelopes shall bear the following:** be addressed to the Employer at the following address: Attention: **Superintending Engineer (Grid & Sub-Station), Bangladesh Rural Electrification Board** Address: **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com** DO NOT OPEN BEFORE 12:30 noon Bangladesh Standard Time on Date**: 04 - 01 -2018**
ITT 42.3	For Tender submission purposes only, the Procuring Entity's address is: Attention: **Superintending Engineer (Grid & Sub-Station), Bangladesh Rural Electrification Board** Address (PRIMARY PLACE): **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com** N.B: On the opening date any Tender (s) carried directly by the tenderer or his agent must reach at tender opening place as mentioned in ITT 42.1 of TDS before 12-00 noon(BST).
	Address (SECONDARY PLACES): **Not Applicable** The deadline for the submission of Tenders is: Time & Date: [same time and date as specified in ITT 42.1]
F. Tender Opening and Evaluation	
ITT 48.1	The Tender opening shall take place at Address: **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com** Time & Date: 12:30 PM on 04 - 01 -2018

ITT 56.1	**Only the Technically Responsive Tender will be considered for Financial Evaluation**:
G. Contract Award	
ITT 64.1	The amount of Performance Security shall be 10% percent of the Contract Price.
ITT 68.1	No Adjudicator is proposed.
ITT 72.1	Any Tenderer has the right to complain to **Superintending Engineer (Grid & Sub-Station). Bangladesh Rural Electrification Board** in accordance with Section 29 of the Public Procurement Act 2006 and Part 12 of Chapter Three of the Public Procurement Rules, 2008.

Section 3. General Conditions of Contract

A. General

1. Definitions

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

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

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

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

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

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

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

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

(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 execute, complete, and maintain the Works.

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

(j) Contractor means the Person under contract with the Procuring Entity for the execution of Works under the Rules and the Act as stated in the PCC.

(k) 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 execution, completion and maintenance of the Works in accordance with the provisions of the Contract.

(l) Contractor's Tender is the completed Tender Document including the priced Bill of Quantities and the Schedules submitted by the Contractor to the Procuring Entity.

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

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

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

(r) Drawings include calculations and other information provided in Section 9 or as approved by the Project Manager for the execution and completion of the Contract.

(s) Goods mean the Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

(t) Equipment is the Contractor's apparatus, machinery, vehicles and other things required for the execution and completion of the Works and remedying any defects excluding Temporary Works and the Procuring Entity's Equipment (if any), Plant, Materials and any other things to form or forming part of the Permanent Works.

(u) 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 85.;

(v) GCC means the General Conditions of Contract.

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

(x) "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;

(y) 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.

(z) 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.

(aa) Month means calendar month.

(bb) Original Contract Price is the Contract Price stated in the Procuring Entity's Notification of Award (Form PW3-7) and further clearly determined in the PCC.

(cc) Permanent works means the permanent works to be executed by

the Contractor under the Contract.

(dd) PCC means the Particular Conditions of Contract.

(ee) Plant means the apparatus, machinery and other equipment intended to form or forming part of the Permanent Works, including vehicles purchased for the Procuring Entity and relating to the construction of the Works and Physical services.

(ff) Procuring Entity means a Procuring Entity having administrative and financial powers to undertake procurement of Works and Physical services using public funds and is as named in the PCC who employs the Contractor to carry out the Works.

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

(hh) Provisional Sums means amounts of money specified by the Procuring Entity in the Bill of Quantities which shall be used, at its discretion, for payments to Nominated Subcontractor(s) and for meeting other essential expenditures under the Contract pursuant to GCC Sub Clause 77.

(ii) Retention Money means the accumulated retention moneys which the Procuring Entity retains under GCC Clause 72.

(jj) 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.

(kk) Site means the places where the Permanent Works are to be executed including storage and working areas and to which Plant and Materials are to be delivered, and any other places as may be specified in the PCC as forming part of the Site.

(ll) 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.

(mm) Specification means the Specification of the Works included in the Contract and any modifications or additions to the specifications made or approved by the Project Manager in accordance with the Contract.

(nn) Start Date is the date defined in the PCC and it is the last date when the Contractor shall commence execution of the Works under the Contract.

(oo) 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.

(pp) Temporary Works means all temporary works of every kind other than Contractor's Equipment required on the Site for the execution and completion of the Permanent Works and remedying of any defects.

(qq) Variation means any change to the Works 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.

(rr) 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.

(ss) 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 of the Contract. Words have their normal meaning under the language of the Contract unless specifically defined.

2.2 Entire Agreement

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

2.3 Non waiver

(a) Subject to GCC Sub Clause 2.3(b), no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, neither shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

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

2.4 Severability

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

2.5 Sectional completion

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

3. Communications and Notices

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

the PCC.

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

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

4. 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 or Bangla. Supporting documents and printed literature that are part of the Contract may be in another language, provided they are accompanied by an accurate translation of the relevant passages in English, in which case, for purposes of interpretation of the Contract, such translation shall govern.

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

6. Documents Forming the Contract and Priority of Documents

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

(a) the signed Contract Agreement (**Form PW3-8**);

(b) the Notification of Award (**PW3-7**);

(c) the completed Tender and the appendix to the Tender;

(d) the Particular Conditions of Contract;

(e) the General Conditions of Contract;

(f) the Technical Specifications;

(g) the General Specifications;

(h) the Drawings;

(i) the priced Bill of Quantities and the Schedules; and

(j) Any other document listed in the **PCC** forming part of the Contract.

7. Scope of Works

7.1 The Works to be executed, completed and maintained shall be as specified in the Bill of Quantities, the General and Particular Specifications and Drawings.

7.2 Unless otherwise stipulated in the Contract, the Works shall include all such items not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for completion of the Works as if such items were expressly mentioned in the Contract.

8. Assignment

8.1 Neither the Contractor nor the Procuring Entity shall assign, in whole or in part, its obligations under the Contract

9. Eligibility

9.1 The Contractor and its 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 shown in the tender or in the Contract, have been given or received in connection with the procurement process or in the Contract execution.

11. Confidential Details

11.1 The Contractor's and the Procuring Entity's personnel shall disclose all such confidential and other information as may be reasonably required in order to verify the Contractor's compliance with the Contract and allow its proper implementation.

11.2 Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

12. JVCA

12.1 If the Contractor is a JVCA ,

(a) each partner of the JVCA shall be jointly and severally liable for all liabilities and ethical or legal obligations to the Procuring Entity for the fulfilment of the promises of the Contract;

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

(c) the JVCA shall notify the Procuring Entity of its composition and legal status which shall not be altered without the prior approval of the Procuring Entity.

(d) (d) Alteration of partners shall only be allowed if any of the partners is found to be incompetent or has any serious difficulties which may impact the overall implementation of the works.

13. Possession of the Site

13.1 The Procuring Entity shall give possession of the Site or part(s) of the Site, to the Contractor on the date(s) stated in the **PCC**. If possession of a part of the Site is not given by the date stated in the **PCC**, the Procuring Entity will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event as stated under GCC Sub Clause 69.1(a).

14. Access to the Site

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

15. Procuring Entity's Responsibilities

15.1 The Procuring Entity shall pay the Contractor, in consideration of the satisfactory progress of execution and completion of the Works and Physical services, and the remedying of defects therein, the Contract price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract Agreement.

15.2 The Procuring Entity shall make its best effort to guide and assist the Contractor in obtaining, if required, any permit, licence, and approvals from local public authorities for the purpose of execution of the Works and Physical services under the Contract.

16. Approval of the Contractor's Temporary Works

16.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, who is to approve them, if they comply with the Specifications and Drawings.

16.2 The Contractor shall be responsible for design of Temporary Works.

16.3 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

16.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

17. Contractor's Responsibilities

17.1 The Contractor shall execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract Agreement.

18. Taxes and Duties

18.1 The Contractor shall be entirely responsible for all taxes, duties, fees, and other such levies imposed inside and outside Bangladesh.

19. Contractor's Personnel

19.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel, as referred to in the **PCC**, to carry out the functions stated in the Schedule or other personnel approved by the Project Manager.

19.2 The Project Manager will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are equal to or higher than those of the personnel named in the Schedule.

19.3 If the Project Manager asks the Contractor to remove a particular person who is a member of the Contractor's staff or work force from the Site, he or she shall state the reasons, and the Contractor shall ensure that the person leaves the Site within three (3) days and has no further connection with the work in the Contract.

20. Subcontracting

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

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

20.3 Subcontractors shall comply with the provisions of GCC Clause 39.

21. Nominated Subcontractor

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

21.2 The Contractor shall not be under obligations to employ a Nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Project manager as soon as practicable, with supporting particulars while there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength, or does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor.

21.3 Subcontracting shall in no event relieve the Contractor from any of its obligations, duties, responsibilities, or liability under the Contract and all Subcontractors shall comply with the provisions of GCC Clause 39.

22. Other Contractors

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

23. Project Manager's Decisions

23.1 Except where otherwise specifically stated in the **PCC**, the Project Manager will decide Contractual matters between the Procuring Entity and the Contractor in its role as representative of the Procuring Entity.

24. Delegation

24.1 The Project Manager may delegate any of his duties and responsibilities to his representative except to the Adjudicator, after notifying the Contractor, and may cancel any delegation, without retroactivity, after notifying the Contractor.

24.2 Any communications to the Contractor in accordance with such delegation shall have the same effect as if it was given by the Project Manager.

25. Instructions,

25.1 The Contractor shall carry out all instructions of the Project Manager that comply with the applicable law.

26. Queries about the Contract conditions

26.1 The Project Manager, on behalf of the Procuring Entity, will clarify queries on the Conditions of Contract.

27. Safety, Security and Protection of the Environment

27.1 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.

28. Working Hours

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

29. Welfare of Labourers

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

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

29.3 The Contractor, further in particular, shall pay reasonable wages to his

or her labourers, and pay them in time. In the event of delay in payment the Procuring Entity may effect payments to the labourers and recover the cost from the Contractor.

30. Child Labour

30.1 The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development in compliance with the applicable labor laws and other relevant treaties ratified by the government.

31. Discoveries

31.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Procuring Entity. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

32. Procuring Entity's and Contractor's Risks

32.1 The Procuring Entity carries the risks that the Contract states are Procuring Entity's risks and the Contractor carries the risks that the Contract states are Contractor's risks.

33. Procuring Entity's Risks

33.1 From the Start Date until the Defects Correction Certificate has been issued, the following are Procuring Entity's risks:

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

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

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

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

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

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

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

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

34. Contractor's Risks

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

35. Copyright

35.1 The copyright in all drawings, documents, and other materials containing data and information furnished to the Procuring Entity by the Contractor herein shall remain vested in the Contractor, or, if they are furnished to the Procuring Entity directly or through the Contractor

by any third party, including Suppliers of materials, the copyright in such materials shall remain vested in such third party.

35.2 The Contractor shall not, except for the purposes of performing the obligations under the Contract, without the written permission of the Procuring Entity disclose or make use of any specification, plan, design and drawing, pattern, sample or information furnished by or on behalf of the Procuring Entity.

36. Limitation of Liability

36.1 Except in cases of criminal negligence or wilful misconduct:

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

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

37. Insurance

37.1 The Contractor shall provide, in the joint names of the Procuring Entity and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles specified in the **PCC** for the following events which are due to the Contractor's risks:

(a) loss of or damage to the Works, Plant, and Materials;

(b) loss of or damage to Equipment;

(c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and

(d) personal injury or death.

37.2 The Contractor shall deliver policies and certificates of insurance to the Project Manager, for the Project Manager's approval, before the Start Date. All such insurances shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

37.3 If the Contractor does not provide any of the policies and certificates required, the Procuring Entity may effect the insurance which the Contractor should have provided and recover the premiums the Procuring Entity has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

37.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager.

37.5 Both parties shall comply with conditions of the insurance policies.

38. Management and Progress Meetings

38.1 Either the Project Manager or the Contractor may require the other to attend a management and progress meeting. The business of such meeting shall be to review the progress and plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

38.2 The Project Manager shall record the business of the meetings and provide copies of the record to those attending the meeting and to the Procuring Entity. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management and progress meeting or after the meeting, and stated in writing to all concerned.

39. Corrupt, Fraudulent, Collusive or Coercive Practices

39.1 The Government requires that Procuring Entity, as well as the Contractor shall observe the highest standard of ethics during the implementation of procurement proceedings and the execution of the Contract under public fund.

39.2 For the purposes of GCC Sub Clause 39.4, the terms set forth below as follows:

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

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

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

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

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

39.3 Should any corrupt, fraudulent, collusive, coercive or obstructive practice of any kind come to the knowledge of the Procuring Entity, 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 exclusion 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 Procuring Entity related to matters of alleged corrupt, fraudulent, collusive, coercive or obstructive practices shall be in writing.

39.4 If corrupt, fraudulent, collusive, coercive or obstructive practices of any kind determined by the Procuring Entity against the Contractor alleged to have carried out such practices, the Procuring Entity 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.

39.5 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.

39.6 The Contractor shall permit the Procuring Entity and/or the Development Partner to inspect the Contractor's accounts and records and other documents relating to the submission of tender and contract performance, and to have them audited by auditors appointed by the Procuring Entity and/or the Development Partner, if so required.

B. Time Control

40. Commencement of Works

40.1 Except otherwise specified in the **PCC** , the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Project Manager's instruction recording the agreement of both Parties on such fulfilment and instructing to commence the Works is received by the Contractor:

(a) signing of the Contract Agreement by both parties upon approval of the by relevant authorities;

(b) possession of the Site given to the Contractor as required for the commencement of the Works; and

(c) receipt by the Contractor of the Advance Payment under GCC Clause 75 provided that the corresponding Bank Guarantee has been delivered by the Contractor, if any.

40.2 The Contractor shall commence the execution of the Works as soon as is reasonably practicable by the **Start Date** as specified in the GCC Sub Clause **1.1(nn)** after the Commencement Date, and shall then proceed with the Works with due expedition and without delay.

41. Completion of Works

41.1 The Contractor shall carry out the Works in accordance with the Programme of Works submitted by the Contractor and as updated with the approval of the Project Manager as stated under GCC Clause 42 to complete them in all respects by the Intended Completion Date.

42. Programme of Works

42.1 Within the time stated in the **PCC**, the Contractor shall submit to the Project Manager for approval a Programme of Works showing the general methods, arrangements, order, and timing for all the activities in the Works. The programme may be in the form of an Implementation Schedule prepared in any software or other form acceptable to the Project Manager.

42.2 The Contractor shall submit to the Project Manager for approval of an updated Programme at intervals no longer than the period stated in the **PCC**. An update of the Programme shall be a Programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

42.3 If the Contractor does not submit an updated Programme of Works at the intervals as stated under GCC Sub Clause 42.2 , the Project Manager may withhold an amount as stated in the **PCC** from the next payment certificate and continue to withhold this amount until the next due payment after the date on which the overdue Programme of Works has been submitted.

42.4 The Project Manager's approval of the Programme of Works shall not alter the Contractor's obligations. The Contractor may revise the Programme and submit it to the Project Manager again at any time for approval. A revised Programme shall show the effect of Variations and Compensation Events.

43. Pro Rata Progress

43.1 The Contractor shall maintain Pro Rata progress of the Works. Progress to be achieved shall be pursuant to GCC Clause 42 and shall be determined in terms of the value of the works done.

44. Early Warning

44.1 If at any time during performance of the Contract, the Contractor or its Subcontractors should encounter events, circumstances, conditions that may adversely affect the quality of the work, increase the original Contract Price or delay the execution of the Works, the Contractor shall promptly notify the Project Manager in writing of the delay, its likely duration, and its cause. As soon as practicable after receipt of the Contractor's notice, the Project Manager shall evaluate the situation, and the Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced.

44.2 The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the original Contract price and Completion Date. The Contractor shall provide the estimate and the Project Manager shall further proceed as soon as reasonably possible.

45. Extension of Intended Completion Date

45.1 The Contractor shall be entitled to an extension of the Intended Completion Date, if and to the extent that completion of the Works or any part thereof is or will be delayed by Compensation Events or a Variation or Extra Work Order.

45.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within twenty-one (21) days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the extension of Intended Completion Date.

45.3 Except in case of Force Majeure, as provided under GCC Clause 85, a delay by the Contractor in the performance of its Completion obligations shall render the Contractor liable to the imposition of Liquidated Damages pursuant to GCC Clause 73, unless an extension of Intended Completion Date is agreed upon, pursuant to GCC Clause 45.

46. Delays Caused by Authorities

46.1 If the following conditions apply, namely:

(a) the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities,

(b) these public authorities delay or disrupt the Contractor's work, and

(c) the delay or disruption was unforeseeable;

then this delay or disruption will be considered as a cause of delay under GCC Sub Clause 45.1.

46.2 The Project Manager shall notify the Contractor accordingly keeping the Procuring Entity posted.

47. Acceleration

47.1 When the Procuring Entity wants the Contractor to finish the Works before the Intended Completion Date, the Project Manager will obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Procuring Entity accepts these proposals, the Intended Completion Date will be advanced accordingly and confirmed by both the Procuring Entity and the Contractor.

47.2 If the Procuring Entity accepts the Contractor's priced proposals for acceleration, they will be incorporated in the Contract Price and treated as a **Variation** under GCC Clause 62.

48. Delays Ordered by the Project Manager

48.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

49. Suspension of Work

49.1 The Project Manager may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

50. Consequences of Suspension

50.1 If the Contractor suffers delay and/or incurs Cost from complying with the Project Manager's instructions under GCC Clause 49 and/or from resuming the work, the Contractor shall give notice to the Project Manager and shall be entitled subject to GCC Clause 93 to:

(a) an extension of time for any such delay, if Completion is or will be delayed and

(b) payment of any such cost, which shall be included in the Contract Price.

50.2 After receiving this notice, the Project Manager shall proceed to agree or determine these matters.

50.3 The Contractor shall not be entitled to any extension of time for, or to any payment of the cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with GCC Clause 49.

C. Quality Control

51. Execution of Works

51.1 The Contractor shall construct, install and carry out the Works and Physical services in accordance with the Specifications and Drawings as scheduled in GCC Clause 6.

52. Examination of Works before covering up

52.1 All works under the Contract shall at all times be open to examination, inspection, measurements, testing and supervision of the Project Manager, and the Contractor shall ensure presence of its representatives at such actions provided proper advance notice is given by the Project Manager.

52.2 No part of the Works shall be covered up or put out of sight without the approval of the Project Manager. The Contractor shall give notice in writing to the Project Manager whenever any such part of the Works is ready for examination and the Project Manager shall attend to such examination without unreasonable delay.

53. Identifying Defects

53.1 The Project Manager shall check the works executed by the Contractor and notify the Contractor of any Defects found. Such checking shall not relieve the Contractor from his or her obligations. The Project Manager may also instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

54. Testing

54.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

55. Rejection of Works

55.1 If, as a result of an examination, inspection, measurement or testing, of Works it is found to be defective or otherwise not in accordance with the Contract, the Project Manager may reject the Works by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected Works subsequently complies with the Contract.

56. Remedial Work

56.1 Notwithstanding any test or certification, the Project Manager may instruct the Contractor to:

(a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,

(b) remove and re-execute any other work which is not in accordance with the Contract, and

(c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

56.2 **The Contractor shall comply with the instruction issued under GCC Sub Clause 56.1 within a reasonable time, which shall be specified in the instruction, or immediately if urgency is specified under GCC Sub Clause 56.1(c).**

56.3 If the Contractor fails to comply with the instruction issued under GCC Sub Clause 56.2, the Procuring Entity shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall be liable to pay all such costs arising from this failure.

57. Correction of Defects

57.1 The Project Manager shall give notice to the Contractor, with a copy to the Procuring Entity and others concerned, of any Defects before the end of the Defects Liability Period, which begins at Completion Date, and is defined in the **PCC**. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

57.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.

58. Uncorrected Defects

58.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected by it, and the Contractor shall remain liable to pay the expenditures incurred on account of correction of such Defect.

D. Cost Control

59. Contract Price

59.1 The Contract Price shall be as specified in the Contract Agreement subject to any additions and adjustments thereto, or deductions therefrom, as may be made pursuant to Contract

60. Bill of Quantities

60.1 The Bill of Quantities shall contain priced items for the construction, installation, testing, and commissioning work to be done by the Contractor.

60.2 The Bill of Quantities is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

61. Changes in the Quantities and Unit Rate or Price

61.1 If the final quantity of the work done for any particular item increases from the quantity in the Bill of Quantities by more than twenty-five percent (25%), provided the change in case exceeds one percent (1%) of the original Contract Price, the Project Manager shall adjust the rate to allow for the change.

61.2 If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.

62. Variations

62.1 All Variations and Extra Work Orders under the Contract shall be included in the updated Programme of Works produced by the Contractor.

63. Costing of Variations or Extra Orders

63.1 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

63.2 If the work in the Variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work not above the limit stated in GCC Sub-Clause 61.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

63.3 If the Contractor's quotation is found to be unreasonable, the Project Manager may order the Variation and make a change to the Contract price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.

63.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event under GCC Sub Clause 69.

63.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning under GCC Sub Clause 44.1.

64. Cash Flow Forecasts

64.1 When the Programme of Works is updated under GCC Sub Clause 42.2, the Contractor shall provide the Project Manager with an updated cash flow forecast.

65. Payment Certificates

65.1 The basis for payment certificates shall be Bill of Quantities used to determine the Contract price.

65.2 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the works executed less the cumulative amount certified previously.

65.3 The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.

65.4 The value of work executed shall be determined by the Project Manager.

65.5 The value of work executed shall include the valuation of Variations or Extra Work Orders, Certified Dayworks and Compensation Events.

65.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

66. Payments to the Contractor

66.1 Payments shall be adjusted for deductions for advance payments and retention. The Procuring Entity shall pay the Contractor the amounts certified by the Project Manager within twenty eight (28) days of the date of each certificate after due adjustments for deductions for advance payments, retention and any other additions or deductions which may have become due under the Contract or otherwise, including those under GCC Clause 93.

66.2 Items of works quantified in the Bill of Quantities for which no rates or prices have been quoted shall be deemed covered by the amounts at rates and prices of other items in the Contract.

66.3 Payments due to the Contractor in each certificate shall be made into the Bank Account in any scheduled Bank of Bangladesh of the title of the Contract specified in the **PCC**, nominated by the Contractor in the currency specified in the Contract.

67. Delayed Payment

67.1 If the Procuring Entity makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made at the prevailing rate of interest for commercial borrowing for each of the currencies in which payments are made.

67.2 If an amount certified is increased in a subsequent certificate as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

68. Payments to Nominated Subcontractor(s)

68.1 The Contractor shall pay to the Nominated Subcontractor(s) the amounts shown on the Nominated Subcontractor's invoices approved by the Contractor which the Project Manager certifies to be due in accordance with the subcontract included under the Contract.

69. Compensation Events

69.1 The following shall be Compensation Events:

(a) The Procuring Entity does not give access to or possession of the Site or part of the Site by the Site Possession Date stated in the GCC Sub Clause 13.1;

(b) The Procuring Entity modifies the Schedule of other Contractors in a way that affects the works of the Contractor under the Contract;

(c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time;

(d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects;

(e) The Project Manager unreasonably does not approve a subcontract to be let, if applicable;

(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Notification of Award from the information issued to Tenderers (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site;

(g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Procuring Entity, or additional work required for safety or other reasons;

(h) Other Contractors, public authorities, utilities, or the Procuring Entity do not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor;

(i) The advance payment is delayed;

(j) The effects on the Contractor of any of the Procuring Entity's Risks;

(k) The Project Manager unreasonably delays issuing a Completion Certificate;

(l) A situation of Force Majeure has occurred, as defined in GCC Clause 85; and

(m) Other Compensation Events described in the Contract or determined by the Project Manager in the **PCC** shall apply.

69.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract price shall be increased and whether and by how much the Intended Completion Date shall be extended, only on justifiably acceptable grounds duly recorded.

69.3 As soon as the Contractor has provided information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost, the Project Manager shall assess it, and the Contract price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract price based on the Project Manager's own forecast. The Project Manager will assume that the Contractor will react competently and promptly to the event.

69.4 The Contractor shall not be entitled to compensation to the extent that the Procuring Entity's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Project Manager.

70. Adjustments for Changes in Legislation

70.1 Unless otherwise specified in the Contract, if between the date twenty-eight (28) days before the submission of Tenders for the Contract and the date of the last Completion Certificate, any law, regulation, ordinance, order or bylaw having the force of law is enacted, promulgated, abrogated, or changed in Bangladesh (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the Completion Date and/or the Contract price, then such Completion Date and/or Contract price shall be correspondingly increased or decreased, to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract.

70.2 The Project Manager shall adjust the Contract Price on the basis of the change in the amount of taxes, duties, and other levies payable by the Contractor, provided such changes have not already been accounted for in the price adjustment as defined in GCC Clause 69 and/or reflected in the Contract price.

71. Price Adjustment

71.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the **PCC**. If so provided, the amounts as certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amount. The formula indicated below applies:

P= A + B (Im/Io)

where:

P is the adjustment factor

A and **B** are Coefficients specified in the **PCC**, representing the nonadjustable and adjustable portions, respectively, of the Contract; and

Im is the Index during the month the work has been executed and **Io** is the Index prevailing twenty eight (28) days prior to the deadline for submission of Tender.

The Indexes to be used is as published by the Bangladesh Bureau of Statistics (BBS) on a monthly basis. In case not available, then other countries or authorities of the sources mentioned in **Appendix to the Tender** may be used.

72. Retention Money

72.1 The Procuring Entity may retain from each progressive payment due to the Contractor at the percentage specified in the **PCC** until completion of the whole of the Works under the Contract.

72.2 On completion of the whole of the Works, the first half the total amount retained under GCC Sub Clause 72.1 shall be repaid to the Contractor and the remaining second half after the Defects Liability Period has passed and the Project Manager has certified in the form of **Defects Corrections Certificate.**.

72.3 On completion of the whole of the Works, the Contractor may substitute an unconditional Bank Guarantee in the format as specified (**Form PW3-11**) acceptable to the Procuring Entity for the second half of the retention money as stated under GCC Sub Clause 72.2.

73. Liquidated Damages

73.1 The Contractor shall pay liquidated damages[16] to the Procuring Entity at the rate per day stated in the **PCC** for each day that the Completion Date is later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount defined in the **PCC**. The Procuring Entity may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

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

73.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.

74. Bonus

74.1 The Contractor shall be paid a Bonus calculated at the rate per calendar day **if stated in the PCC** for each day (less any days for which the Contractor is paid for acceleration) that the Completion of the whole of the Works is earlier than the Intended Completion Date. The Project Manager shall require certifying that the Works are complete, although they may not have fallen due to being complete as per approved updated Programme of Works.

75. Advance Payment

75.1 If so specified in the **PCC,** the Procuring Entity shall make advance payment to the Contractor of the amounts and by the dates stated in the **PCC** against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Procuring Entity in an amount equal to the advance payment. The Guarantee shall remain effective until the advance payment has been repaid, but the amount of the Guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

75.2 The Contractor shall use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used for such specific purposes by supplying copies of invoices or other documents to the Project Manager.

75.3 The advance payment shall be repaid by deducting at proportionate rate from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.

76. Performance Security

76.1 The Procuring Entity shall notify the Contractor of any claim made against the Bank issuing the Performance Security.

76.2 The Procuring Entity may claim against the security if any of the following events occurs for fourteen (14) days or more.

(a) The Contractor is in breach of the Contract and the Procuring Entity has duly notified him or her ; and

(b) The Contractor has not paid an amount due to the Procuring Entity and the Procuring Entity has duly notified him or her.

76.3 In the event the Contractor is liable to pay compensation under the Contract amounting to the full value of the Performance Security or more, the Procuring Entity may call the full amount of the Performance Security.

76.4 The Performance Security furnished at the time of signing of the Contract Agreement shall be substituted, after the issuance of certificate of Completion of works by the Project Manager, by a new Security covering fifty (50) percent amount of the Performance Security to cover the Defects Liability Period.

76.5 If there is no reason to call the Performance Security, the Performance Security shall be discharged by the Procuring Entity and returned to the Contractor after the Defects Liability period has passed and the Project Manager has certified in the form of Defects Corrections Certificates. .

77. Provisional Sums

77.1 Provisional Sums shall only be used, in whole or in part, in accordance with the Project Manager's instructions and the Contract price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Project Manager shall have instructed.

77.2 Plants, Materials or Services to be purchased by the Contractor under the provisions of GCC Sub Clause 77.1 from Nominated Subcontractor(s) or for meeting the other expenditures under the Contract, and for which there shall be included in the Contract price, the actual amounts paid or due to be paid by the Contractor, and a sum for VAT, profit and overhead charges, as applicable, calculated as a percentage of these actual amounts by applying the relevant percentage rate stated in the **PCC**.

77.3 The Contractor shall, when required by the Project Manager, produce quotations, invoices, vouchers and accounts or receipts in substantiation of purchases under GCC Sub Clause 77.2.

78. Day works

78.1 If applicable, the Day works rates in the Contractor's Tender shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

78.2 All works to be paid for as Day works shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be certified and signed by the Project Manager within seven (7) days of the works being done.

78.3 The Contractor shall be paid for Day works subject to obtaining signed Day works forms.

79. Cost of Repairs to Loss or Damages

79.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Liability Period shall be remedied by the Contractor at the Contractor's own cost, if the loss or damage arises from the Contractor's acts or omissions.

E. Completion of the Contract

80. Completion

80.1 The Contractor shall apply by notice to the Project Manager for issuing a Completion Certificate of the Works, and the Project Manager shall do so upon deciding that the work is completed.

81. Taking Over

81.1 The Procuring Entity shall take over the Site and the Works within seven (7) days of the Project Manager's issuing a certificate of Completion.

82. Amendment to Contract

82.1 The amendment to Contract shall generally include extension of time to the Intended Completion Date, increase or decrease in original Contract price and any other changes acceptable under the conditions of the Contract.

82.2 The Procuring Entity, in accordance with the Delegation of Financial Power or sub-delegation thereof, shall amend the Contract incorporating the changes introduced to the original terms and conditions of the Contract in line with the Rules.

83. Final Account

83.1 The Contractor shall submit with a detailed account of the total amount that the Contractor considers payable under the Contract to the Project Manager before the end of the **Defects Liability Period**.

83.2 The Project Manager shall certify the **Final Payment** within fifty six (56) days of receiving the Contractor's account if the payable amount claimed by the Contractor is correct and the corresponding works are completed.

83.3 If it is not, the Project Manager shall issue within fifty six (56) days a **Defects Liability Schedule** that states the scope of the corrections or additions that are necessary.

83.4 If the **Final Account of Works** submitted under GCC Sub Clause 83.1 is unsatisfactory even after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.

84. As-built Drawings and Manuals

84.1 If "As Built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the **PCC**.

84.2 If the Contractor does not supply the Drawings and/or Manuals by the dates specified in GCC Sub Clause 84.1, or they do not receive the Project Manager's approval, the Project Manager shall withhold a nominal amount specified in the **PCC** from payments due to the Contractor.

85. Force Majeure

85.1 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind stated below;

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies ;

(b) rebellion, terrorism, sabotage by persons other than the Contractor's personnel, revolution, insurrection, military or usurped power, or civil war ;

(c) riot, commotion, disorder, strike or lockout by persons other than the Contractor's personnel ;

(d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity ;

and

(e) natural catastrophes such as fires, floods, epidemics, quarantine restrictions, freight embargoes, cyclone, hurricane, typhoon, tsunami, storm surge, earthquake, hill slides, landslides, and volcanic activities.

86. Notice of Force Majeure

86.1 If a party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice, within fourteen (14) days after the party became aware, to the other party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented.

86.2 Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either party to make payments to the other party under the Contract.

87. Consequences of Force Majeure

87.1 If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under GCC Sub Clause 86, and suffers delay and/or incurs cost by reason of such Force Majeure, the Contractor shall be entitled subject to GCC Sub Clause 93 to:

(a) an extension of time for any such delay, if completion is or will be delayed, under GCC Clause 45, and

(b) if the event or circumstance is of the kind described sub-paragraphs (a) to (e) of GCC Sub Clause 85.1 occurs in the Country, payment of any such cost, including the costs of rectifying or replacing the Works and Physical services damaged or destructed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in GCC Clause 37.

87.2 After receiving notice under GCC Sub Clause 86.1, the Project Manager shall proceed to determine these matters under the provisions of the Contract.

88. Release from Performance

88.1 Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the parties to be released from further performance of the Contract, then upon notice by either party to the other party of such event or circumstance:

(a) the parties shall be discharged from further performance, without prejudice to the rights of either party in respect of any previous breach of the Contract, and

(b) the sum payable by the Procuring Entity to the Contractor shall be the same as would have been payable under GCC Sub Clause 90.3 if the Contract had been terminated under GCC Sub Clause 89.3.

F. Termination and Settlement of Disputes

89. Termination

89.1 **<u>Termination for Default</u>**

(a) The Procuring Entity or the Contractor, without prejudice to any other remedy for breach of Contract, by giving twenty eight (28) days written notice of default to the other party, may terminate the Contract in whole or in part if the other party causes a fundamental breach of Contract.

(b) Fundamental breaches of the Contract shall include, but shall not be limited to, the following:

(i) the Contractor stops work for twenty-eight (28) days when no stoppage of work is shown on the current Programme and the stoppage has not been authorized by the Project Manager;

(ii) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within eighty four (84) days;

(iii) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project

Manager;

(iv) the Contractor does not maintain a Security, which is required;

(v) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of Liquidated Damages can be paid, as specified in GCC Sub Clause 73;

(vi) the Contractor has subcontracted the whole of the Works or has assigned the Contract without the required agreement and without the approval of the Project Manager;

(vii) the Contractor, in the judgment of the Procuring Entity has engaged in corrupt or fraudulent practices, as defined in GCC Sub Clause 39, in competing for or in executing the Contract.

(viii) A payment certified by the Project Manager is not paid by the Procuring Entity to the Contractor within eighty-four (84) days of the date of the Project Manager's certificate.

89.2 **Termination for Insolvency**

The Procuring Entity and the Contractor may at any time terminate the Contract by giving twenty eight (28) days written notice to the other party if either of the party becomes bankrupt or otherwise insolvent. In such event, termination will be without compensation to any party, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the other party.

89.3 **Termination for Convenience**

(a) The Procuring Entity, by giving twenty eight (28) days written notice sent to the Contractor, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Procuring Entity's convenience, the extent to which performance of the Contractor under the Contract is terminated, and the date upon which such termination becomes effective.

(b) The Procuring Entity shall not terminate the contract under GCC Sub Clause 89.3 (a) in order to execute the Works itself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor as stated under GCC Sub Clause 89.1(a).

89.4 In the event the Procuring Entity terminates the Contract in whole or in part, the Procuring Entity shall accept the portion of the Works that are complete and ready for handing over after the Contractor's receipt of notice of termination of the Contract. For the remaining portion of the Works, the Procuring Entity may elect:

(a) to have any portion completed by the Contractor at the Contract terms and prices; and /or

(b) to cancel the remainder and pay to the Contractor an agreed amount for partially completed Works and for materials and parts previously procured by the Contractor, or

(c) except in the case of termination for convenience as stated under GCC Sub Clause 89.3., engage another Contractor to complete the Works, and in that case the Contractor shall be liable to the Procuring Entity for any cost that may be

incurred in excess of the sum that would have been paid to the Contractor, if the work would have been executed and completed by him or her.

89.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as is reasonably possible

90. Payment upon Termination

90.1 If the Contract is terminated because of a fundamental breach of Contract under GCC Sub Clause 89.1 by the Contractor, the Project Manager shall issue a certificate for the value of the Works done and Plant and Materials ordered less advance payments received up to the date of the issue of the certificate and less the amount from percentage to apply to the contract value of the works not completed, as indicated in the **PCC**. If the total amount due to the Procuring Entity exceeds any payment due to the Contractor, the difference shall be a debt payable to the Procuring Entity.

90.2 If the Contract is terminated for the Procuring Entity's convenience or because of a fundamental breach of Contract by the Procuring Entity, the Project Manager shall issue a payment certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's foreign personnel employed solely on the Works and recruited specifically for the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

90.3 If the Contract is terminated for reasons of Force Majeure, the Project Manager shall determine the value of the work done and issue a Payment Certificate which shall include:

(a) the amounts payable for any work carried out for which unit rates or prices are stated in the Contract;

(b) the cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Procuring Entity when paid for by the Procuring Entity, and the Contractor shall place the same at the Procuring Entity's disposal;

(c) other costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;

(d) the cost of removal of Temporary Works and Contractor's Equipment from the Site; and

(e) the cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.

91. Property

91.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Procuring Entity if the Contract is terminated because of the Contractor's default stated under GCC Sub Clause 89.1.

92. Frustration

92.1 If the Contract is frustrated by the occurrence of a situation of Force Majeure as defined in GCC Sub Clause 85, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all works carried out before receiving it and for any work carried out afterwards to which a commitment was made.

G. Claims, Disputes and Arbitration

93. Contractor's Claims

93.1 If the Contractor considers himself to be entitled to any extension of the Completion Time and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Procuring Entity, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than twenty eight (28) days after the Contractor became aware, or should have become aware, of the event or circumstance.

93.2 If the Contractor fails to give notice of a claim within such period of twenty eight (28) days, the Intended Completion Date shall not be extended, the Contractor shall not be entitled to additional payment, and the Procuring Entity shall be discharged from all liability in connection with the claim.

93.3 Within forty two (42) days after the Contractor became aware or should have become aware of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Project Manager, the Contractor shall send to the Project Manager a fully detailed claim which

includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed, for settlement.

94. Settlement of Disputes

94.1 **Amicable settlement**

The procuring Entity and the Contractor shall use their best efforts to settle amicably all possible disputes arising out of or in connection with this Contract or its interpretation.

94.2 **Adjudication**

(a) If the Contractor believes that a decision taken by the Project Manager was either outside the authority given to the Project Manager by the Contract or that the decision was wrongly taken, the decision shall be referred to the Adjudicator within fourteen (14) days of notification of the Project Manager's decision in writing.

(b) The Adjudicator named in the **PCC** is jointly appointed by the parties. In case of disagreement between the parties, the Appointing Authority designated in the **PCC** shall appoint the Adjudicator within fourteen (14) days of receipt of a request from either party.

(c) The Adjudicator shall give its decision in writing to both parties within twenty-eight (28) days of a dispute being referred to it.

(d) The Contractor shall make all payments (fees and reimbursable expenses) to the Adjudicator, and the Procuring Entity shall reimburse half of these fees through the regular progress payments.

(e) Should the Adjudicator resign or die, or should the Procuring Entity and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract; a new Adjudicator will be jointly appointed by the Procuring Entity and the Contractor. In case of disagreement between the Procuring Entity and the Contractor the Adjudicator shall be designated by the Appointing Authority within fourteen (14) days of receipt of a request from either party as stated under GCC Sub Clause 94.2 (b)

94.3 **Arbitration**

(a) If the parties are unable to reach a settlement as per GCC Clauses 94.1 and 94.2 within twenty-eight (28) days of the first written correspondence on the matter of disagreement, then either party may give notice to the other party of its intention to commence arbitration in accordance with GCC Sub Clause 94.3(b).

(b) The arbitration shall be conducted in accordance with the Arbitration Act (**Act No 1 of 2001**) of Bangladesh as at present in force and in the place shown in the **PCC**.

Section 4: (Part-I) Particular Conditions of Contract

GCC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract
GCC 1.1(j)	The Contractor is Name : Address : name of authorized representative :
GCC 1.1(ff)	The Procuring Entity is **Superintending Engineer (Grid & Sub-Station),** Bangladesh Rural Electrification Board Address: **Superintending Engineer (Grid & Sub-Station),** Bangladesh Rural Electrification Board, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com**
GCC 1.1 (gg)	**The Project Manager is:** Executive Engineer, Project Division, Bagerhat.
GCC 1.1 (hh)	The project management shall be done under Superintending Engineer, Faridpur Zone, Faridpur, Executive Engineer, Project Division, Bagerhat shall act as Project Manager and shall be responsible for supervising the execution and compl etion of the works and physical services and administering the Contract under Superintending Engineer, Faridpur Zone, Faridpur.
GCC 1.1 (bb)	The original Contract price is the amount stated in the NOA **(PW3-7)**
GCC 1.1(y)	The Intended Completion Date for the whole of the Works shall be 06 (Six) Months from the date of signing of the contract.
GCC 1.1(kk)	The Site is located at 132/33KV BAGERHAT GRID SUB-STATION.
GCC 1.1(nn)	The Start Date shall be from the date of signing of the contract.
GCC 1.1(rr)	The Works consist of items stated in the Bill of quantities (BOQ) in Section-6 against **TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.**
GCC 2.5	The Sectional Completion Dates are **not Applicable**.
GCC 3.1	The Procuring Entity's address for the purpose of communications under this contract is :- **Superintending Engineer (Grid & Sub-Station)**, Bangladesh Rural Electrification Board Address: **Superintending Engineer (Grid & Sub-Station)**, BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229. Telephone: 88-02-8900757 **E-mail no: segridssbreb@gmail.com**

	The Contractor's address for the purpose of communications under this contract is : **Contact person:** Address: Tel**:** Fax**:** e-mail address**:**
GCC 6.1 (j)	other documents forming part of the Contract are; **-** Any other Clarification and Confirmation given by tenderer/supplier if required. Additional Conditions of Particular Application in this Schedule, Schedule of Key personnel, Site investigation Reports, Relevant correspondences prior to signing of the contract in the tender shall form a part of the contract.
GCC 7	The Works to be executed, completed and maintained shall be as specified in the Bill of Quantities (BOQ) in Section-6 in accordance with General and Particular Specifications and Design & Drawings approved by the Employer. Unless otherwise stipulated in the Contract, the Works shall include all such items not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for completion of the Works as if such items were expressly mentioned in the Contract.
GCC 9.1	A Contractor or a Subcontractor/JVC that is a national of, or registered in, the following countries are not eligible: **Israel.**
GCC 9.2	Materials, Equipments Plants and supplies shall not have their origin in the following countries: **Israel.**
GCC 13.1	The site possession date shall be from the date of signing of the contract.
GCC 18.1	The Clause is replaced as follows: (i) "The income tax, surcharge & all taxes of similar nature & VAT & levied on the contractor in Bangladesh in connection with the execution of this contract, including the personnel taxes & other taxes on its personnel, shall be paid by the contractor/JVC & deduction at source will be made at the time of payment from the contractor's invoice as per rule" (ii) The Contractor shall pay all sales, income and other taxes and duties, tariffs and imports that can be lawfully assessed against the Contractor, by the Government or any lawful authority of any country and shall pay for all licenses, permits and inspections required for the works including the cost or securing all export licenses and permits for materials, equipment, supplies and personnel exported from that country to Bangladesh.

(iii) The Contractor shall, at his cost and expense secure, any work permits, labour permits, tax clearances, tax exemption certificate and any other authorization which may be required by the Government of Bangladesh to permit imported personnel of Contractor and its sub-contractors to perform their work at site.

(iv) "All Materials, Plants and Equipment imported to Bangladesh by the contractor will be subject to all Bangladesh import and customs duties. The contractor shall be responsible for and bear the cost of the payment of all duties and taxes required to be paid for the imported materials, plant and equipment and obtaining all permits and licenses for all plant and equipment. Demurrage (if any) and any other charges related to the above import shall also be to the contractor's account."

(v) The Contractor will be responsible for payment of all costs related to clearances of Plant and Equipment at the port of entry, port charges and river dues. The Contractor shall perform all necessary Customs formalities in respect of clearance of materials from the port.

GCC 19.1

Following Key Personnel to carry out the functions stated in the Schedule shall be employed by the Contractor;

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

No	Position	Total Working Experience (overall years)	In Similar Working Experience (Years)
1.	Project Manager (B.Sc. Engineer Electrical/Mechanical 1/1 no.)	**10** Years.	**05** Years.
2.	SiteEngineer(Elec) B.Sc./Diploma Engr.	**5/10** Years.	**03** Years.
3.	SiteEngineer(B.Sc./Diploma Engr. Civil)	**5/10** Years.	**03** Years.
4.	Supervisor,foreman,Lineman for Line construction/ augmentation work (4 nos.)	**05** Years.	**03** Years.

The Number of key staffs mentioned above may required to increase according to site condition.

GCC 21.1

Nominated Subcontractor(s) named below;

Not Applicable

GCC 23.1

The Contractual matters between the Procuring Entity and the Contractor shall be decided by

Superintending Engineer (Grid & Sub-Station),

Bangladesh Rural Electrification Board

Address: **Superintending Engineer (Grid & Sub-Station)**,

BREB- Training Academy Bhaban, 4th Floor, Nikunja-2, Dhaka-1229.

Telephone: 88-02-8900757

E-mail no: segridssbreb@gmail.com

GCC 37.1	**The minimum insurance cover shall be:**	
	(a)	The minimum coverage for insurance due to loss of, or damage to the Works, Plant and Materials in respect of the Contractor's faulty design is 110% of the contract price.
	(b)	The minimum coverage for loss or damage of Equipment is 110% of the replacement value of the equipment**.**
	(c)	The minimum coverage for loss of or damage of property (except the Works, Plant, Materials, and Equipment) in connection with the Contract is 10% of the contract price.
	(d)	The minimum coverage for personal injury or death insurance: (i) for the Contractor's employees is as per the law and common practice in Bangladesh. (ii) and for third parties is as per the law and common practice in Bangladesh.
GCC 40.1	Commencement date of works shall be from the date of signing of the contract.	
GCC 42.1	The Contractor shall submit a Programme for the Works within 15(fifteen) days of signing the Contract for approval.	
GCC 42.2	The period between Programme updates is 30 (Thirty) days.	
GCC 42.3	The amount to be withheld for late submission of an updated Programme is Nil.	
GCC 57.1	The Defects Liability Period is 12 (Twelve) months	
GCC 66.3	The particulars of the Bank Account nominated are as follows : Title of the Account : Name of the Bank : Name of the Branch : Account Number : Address : Tel. No. : e-mail address :	
GCC 69.1(m)	The following additional events shall also be the Compensation Events: Not Applicable	
GCC 71.1	The Contract is **not subject to price adjustment**.	
GCC 72.1	The proportion of payments to be retained is **10% of the contract price**.	
GCC 73.1	The amount of Liquidated Damages or in other words Delay due to Damages for the uncompleted Works or any part thereof is 0.075 of one (1%) percent of its Contract price per day of delay.	

GCC 73.1	The maximum amount of Liquidated Damages for the uncompleted Works or any part thereof is **10% of the final Contract price** of the whole of the Works.
GCC 74.1	The Bonus clause is **Not Applicable**.
GCC 75.1	The Advance Payment shall **Not be Applicable.**
GCC 77.2	The percentage for adjustment of Provisional Sums is **Not Applicable .**
GCC 84.1 **As-built** **Drawing &** **Manuals**	The date by which "as-built" drawings are required is within 28 days after taking over certificate (TOC). The date by which operating and maintenance manuals are required is with in 28 days after taking over certificate (TOC).
GCC 84.2	The amount to be withheld for failing to produce "as-built" drawings and/or operating and maintenance manuals by the date required is the Re-tension money kept for defects liability period.
GCC 90.1	The percentage to apply to the contract value of the works not completed, representing the Procuring Entity's additional cost for completing the uncompleted Works is 20% of the contract price.
GCC 94.2 (b)	The Adjudicator jointly appointed by the parties is: **Not Applicable** **Name: .....** **Address: .....** **Tel No:.....** **Fax No:.....** **e-mail address:.....**
GCC 94.2(b)	In case of disagreement between the parties, the Appointing Authority for the Adjudicator is the President of the Institution of Project Managers (IEB), Bangladesh. **Name: .....** **Address: .....** **Tel No:.....** **Fax No:.....** **e-mail address:.....**
GCC 94.3 (b)	The arbitration shall be conducted in the place mentioned below; Address: Telephone No..... Fax..... [state name of place with location and district]

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

TENDER DOCUMENT

FOR THE

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SECTION 4: PART -III -(LABOUR LAWS)

1. LABOUR LAW

Bangladesh Labour Law shall be applicable for this tender.

Section 5. Tender and Contract Forms

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

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

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

Tender Submission Letter (Form PW3-1)

[This letter should be completed and signed by the Authorised Signatory
on the Letter-Head Pad of the Tenderer]

To: [Contact Person] [Name of the Procuring Entity] [Address of the Procuring Entity]	Date:
Invitation for Tender No:	IFT No. _____
Tender Package No:	Package No. _____
Lot No: (when applicable)	Lot No. _____

We, the undersigned, tender to execute in conformity with the Tender Document, the following Works and physical services, viz:

In accordance with ITT Clause 27 and 28, the following price applies to our Tender:

The Tender price is: (ITT Sub Clause 27.4 and 28.1)	Tk._____ [in figures] Taka_____ [in words]
The advance payment (when applicable) is: [insert the amount based on percentage of the Tender Price] (GCC Sub Clause 73.1)	Taka_____ [in words] Taka_____ [in words]

and we shall accordingly submit an Advance Payment Guarantee in the format shown in Form **PW3–10.**

In accordance with ITT Clauses 27, the following discounts apply to our Tender:	
The unconditional discount for being awarded more than one lot in this package is: (ITT Sub Clause 27.5 and 28.1)	Tk._____ [in figures] Taka _____ [in words]
The methodology for application of the discount is : [state the methodology]. (ITT Sub Clause 27.6 and 28.1)	
Delete **BOX**, if this Tender is being invited for **Single Package or Single Lot**	

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 33.1) 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 36.1) 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 66.2 in the amount stated in the Tender Data Sheet (ITT Sub Clauses 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 Works;

(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 JV 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 40.3
or
we are submitting this Tender as the partners of a JV, comprising the following other partners in accordance with ITT Sub Clause 40.3;

	Name of Partner	Location & District 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;

(h) we, including as applicable any JV 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 JV 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 Works	Name of Subcontractor with Location and District

(l) we, including as applicable any JV 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 PW3-2**);

(m) we are not participating as Tenderer 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 JV 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 JV 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 Tenderer, in accordance with ITT Clause 60.

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

[If there is more than one (1) signatory, or in the case of a JV, add other boxes and sign accordingly].
Attachment 1:
[ITT Sub Clause 40.3]
Written confirmation authorising the above signatory(ies) to commit the Tenderer

[and, if applicable]
Attachment 2:
[ITT Sub Clause 29.2(b)]
Copy of the JV Agreement / Letter of Intent to form JV with draft proposed Agreement

N/A

Financial (Price) Proposal Letter (Form PW3-1B)

Tender (Form)

[This letter should be completed and signed by the Authorised signatory preferably on the Letter-Head Pad of the Tenderer]

To Date:

Superintending Engineer (Grid & Sub-Station),
Bangladesh Rural Electrification Board.

Invitation for Tender No: 27.12.2637.125.31.154.17.555 Date: 30 - 11 -2017

Tender Package No: SE(G&SS)-33KVBB- BAGERHATGr-01

This Package3 is divided into the following Number of Lots **Not Applicable**

We, the undersigned, offer to execute in conformity with the Condition of Contract and associated Contract documents, the following Works and Physical services, viz.

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

In Accordance with ITT Clauses 27 and 28, the following prices apply to our Tender:

The Tender Price is: (ITT sub Clause 27.1)	Tk. [in figures] Taka [in words]
The unconditional discount for being awarded more than one lot in this package is: (ITT sub Clause 27.6)	Tk. [in figures] Taka [in words] **Not Applicable**
The methodology for application of the discount is:	[state the methodology] **Not Applicable**
The advance payment is: (GCC Sub Clause 75.1)	[state the amount based on percentage of the Tender Price] **Not Applicable**

And we shall accordingly submit an Advance Payment Guarantee in the format shown in Form PW3-10.
Not Applicable

In signing this letter, and in submitting our price proposal, we also confirm that: our Financial Proposal shall be evaluated only if our Technical Proposal is responsive upon evaluation by TEC. If our financial proposal is accepted, we commit to furnishing a performance security in the amount stated in the Tender Data Sheet **(ITT sub-clause 64.1)** and valid for a period of 28 days beyond the date of issue of the of Defect correction Certificate of Works under the contract.

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.

We understand that you are not bound to accept the lowest evaluated Financial Proposal or any other Financial Proposal that you may receive. Our Tender shall be valid for the period stated in the Tender Data Sheet **(ITT sub Clause 33.1)** and it shall remain binding upon us and may be accepted at any time before the expiration of that period; 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 60.**

Signature :	[insert signature of authorized representative of the Tenderer]
Name :	[insert full name of signatory with National ID Number]
In the capacity of :	[insert capacity of signatory]
Duly authorized 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 40.3]
Written confirmation authorizing the above signatory (ies) to commit the Tenderer

[and, if applicable]

Attachment 2:
[ITT Sub Clause 29.2(b)]
Copy of the JVCA Agreement / Letter of Intent to form JVCA with draft proposed Agreement.

Tenderer Information (Form PW3-2)

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

Invitation for Tender No: [indicate IFT No]

Tender Package No: [indicate Package No]

This Package is divided into the following Number of Lots: [indicate number of Lot(s)]

1.	Eligibility Information of the Tenderer [ITT –Clauses 5 & 29]	
1.1	Nationality of individual or country of registration	
1.2	Tenderer's legal title	
1.3	Tenderer's registered address	
1.4	Tenderer's legal status [complete the relevant box]	
	Proprietorship	
	Partnership	
	Limited Liability Concern	
	Government-owned Enterprise	
	Others [please describe, if applicable]	
1.5	Tenderer's year of registration	
1.6	Tenderer's authorised representative details	
	Name	
	National ID number	
	Address	
	Telephone / Fax numbers	
	e-mail address	
1.7	Litigation [ITT Cause 13]	
	If there is no history of litigation or no pending litigation then state opposite "None". If there is a history of litigation, or a number of awards, against the Tenderer provide details below	

	A.. Arbitration Awards made against			
	Year	Matter in dispute	Value of Award	Value of Claim
	B. Arbitration Awards pending			
	Year	Matter in dispute	Value of Claim	

1.8	Tenderer to attach photocopies of the original documents mentioned aside	[All documents required under ITT Clauses 5 and 29]
The following two information are applicable for National Tenderers		
1.9	Tenderer's Value Added Tax Registration (VAT) Number	
1.10	Tenderer's Tax Identification Number(TIN)	
[The foreign Tenderers, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]		

2.	Qualification Information of the Tenderer [ITT Clause 32]				
2.1	General Experience in Construction Works of Tenderer				
	Start Month Year	End Month Year	Years	Contract No and Name of Contract Name and Address of Procuring Entity Brief description of Works	Role of Tenderer [Prime/Sub /Management]

2.2	Specific Experience in Construction Works of Tenderer Completed Contracts of similar nature, complexity and methods/construction technology			
	Contract No Name of Contract	[insert reference no] of [insert year] [insert name]		
	Role in Contract [tick relevant box].	Prime Contractor	Subcontractor	Management Contractor
	Award date	[insert date]		

	Completion date Total Contract Value	[insert date] [insert amount]
	Procuring Entity's Name Address Tel / Fax e-mail Brief description with justifications of the similarity compared to the Procuring Entity's requirements	[state justification in support of its similarity compared to the proposed works]

2.3	Average annual construction turnover [ITT Sub Clause15.1(a)] [amount invoiced to Procuring Entity(s) for each year of works in progress or completed, using rate of exchange at the end of the period reported]		
	Year	Amount & Currency	Taka or Equivalent Taka

2.4	Financial Resources available to meet the construction cash flow [ITT Sub Clause 15.1(b)]		
	No	Source of Financing	Amount Available

In order to confirm the above statements the Tenderer shall submit , as applicable, the documents mentioned in ITT Sub Clause 32.1(a), (b), (c) & (d)

2.5	Contact Details [ITT Sub Clause 32.1 (g) & (i)
	Name, address, and other contact details of Tenderer Bankers and other Procuring Entity(s) that may provide references, if contacted by this Procuring Entity
2.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 32.1(e)]

	Position: Name: Years of General Experience:	Years of Specific Experience	
[Tenderer to complete details of as many personnel as are applicable. Each personnel listed above should complete the Personnel Information (Form PW3-5)]			
2.7	Major Construction Equipments proposed to carry out the Contract [ITT Sub Clause 32.1(f)]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, lessor or seller)
[Tenderer to list details of each item of major construction equipment, as applicable]			

JVCA Partner Information (Form PW3-3)

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

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

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

A. Arbitration Awards made against			
Year	Matter in dispute	Value of Award	Value of Claim

	B. Arbitration Awards pending			
	Year	Matter in dispute	Value of Claim	

1.8	JVCA Partner to attach copies of the original documents mentioned aside	[All documents required under ITT Clauses 5 and 29]
The following two information are applicable for national JVCA Partners only		
1.9	JVCA Partner's Value Added Tax Registration (VAT) Number	
1.10	JVCA Partner's Tax Identification Number (TIN)	
[The foreign JVCA Partners, in accordance with ITT Sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]		

2.	Key Activity(ies) for which it is intended to be joint ventured [ITT Sub Clause 18.2 & 18.3]	
	Elements of Activity	Brief description of Activity

3.	Qualification Information of the JVCA Partner [ITT Clause 32]				
3.1	General Experience in Construction Works of JVCA Partner				
	Start Month Year	End Month Year	Years	Contract No and & Name of Contract Name and Address of Procuring Entity Brief description of Works	Role of JVCA Partner [Prime/Sub /Management]

3.2	Specific Experience in Construction Works of JVCA Partner Completed Contracts of similar nature, complexity and methods/construction technology	
	Contract No Name of Contract	[insert reference no] of [insert year] [insert name]

	Role in Contract [tick relevant box]	Prime Contractor	Subcontractor	Management Contractor
	Award date Completion date Total Contract Amount	[insert date] [insert date] [insert amount]		
	Procuring Entity's Name Address Tel / Fax e-mail Brief description with justifications of the similarity compared to the Procuring Entity's requirements	[state justification in support of its similarity compared to the proposed works]		
3.3	Average annual construction turnover [ITT Sub Clause 15.1 (a)] [amount invoiced to Procuring Entity(s) for each year of work in progress or completed, using rate of exchange at the end of the period reported]			
	Year	Amount & Currency	Taka or Equivalent Taka	
3.4	Financial Resources available to meet the construction cash flow [ITT Sub-Clause 15.1(b)]			
	No	Source of financing	Amount available	
	In order to confirm the above statements the JVCA Partner shall submit , as applicable, the documents mentioned in ITT Sub Clause 32.1 (a), (b), (c) & (d)			
3.5	Contact Details [ITT Sub Clause 32.1 (g) & (i)			
	Name, address, and contact details of Tenderer's Bankers and other Procuring Entity(s) that may provide references if contacted by this Procuring Entity			

3.6	Qualifications and experience of key technical and administrative personnel proposed for Contract administration and management [ITT Sub Clause 32.1(e)]		
	Position Name Years of General Experience	Years of Specific Experience	
	[Tenderer to complete details of as many personnel as are applicable. Each personnel listed above should complete the Personnel Information (Form PW3-5)]		
3.7	Major items of Construction Equipment proposed for carrying out the works [ITT Sub-Clause 32.1(f)]		
	Item of Equipment	Condition (new, good, average, poor)	Owned, leased or to be purchased (state owner, leaser or seller)
[Tenderer to list details of each item of Major equipment, as applicable]			

Subcontractor Information (Form PW3-4)

(Not Applicable)

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

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

1.	Eligibility Information of the Subcontractor [ITT –Clauses 5 & 29]	
1.1	Nationality of Individual or country of Registration	
1.2	Subcontractor's legal title	
1.3	Subcontractor's registered address	
1.4	Subcontractor's legal status [complete the relevant box]	
	Proprietorship	
	Partnership	
	Limited Liability Concern	
	Government-owned Enterprise	
	Other (please describe)	
1.5	Subcontractor's year of registration	
1.6	Subcontractor's authorised representative details	
	Name	
	Address	
	Telephone / Fax numbers	
	e-mail address	
1.7	Subcontractor to attach copies of the following original documents	All documents to the extent relevant to ITT Clause 5 and 29 in support of its qualifications
The following two information are applicable for national Subcontractors		
1.8	Subcontractor's Value Added Tax Registration (VAT) Number	
1.9	Subcontractor's Tax Identification Number(TIN)	

[The foreign Subcontractors , in accordance with ITT sub Clause 5.1, shall provide evidence by a written declaration to that effect to demonstrate that it meets the criterion]			
2. Key Activity(ies) for which it is intended to be Subcontracted [ITT Sub Clause 19.1]			
2.1	Elements of Activity	Brief description of Activity	
2.2	List of Similar Contracts in which the proposed Subcontractor had been engaged		
	Name of Contract and Year of Execution		
	Value of Contract		
	Name of Procuring Entity		
	Contact Person and contact details		
	Type of Work performed		

Personnel Information (Form PW3-5)

[This Form should be completed for each person proposed by the Tenderer on Form PW3-2 & PW3-3, where applicable]

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

A. Proposed Position (tick the relevant box)		
☐ Construction Project Manager	☐ Prime Candidate	☐ Alternative Candidate
☐ Key Personnel	☐ Prime Candidate	☐ Alternative Candidate
B. Personal Data		
Name		
Date of Birth		
Years overall experience		
National ID Number		
Years of employment with the Tenderer		
Professional Qualifications: 1. 2. 3. 4.		
C. Present Employment [to be completed only if not employed by the Tenderer]		
Name of 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			
4			
5			

Bank Guarantee for Tender Security (Form PW3-6)

[This is the format for the Tender Security to be issued by a scheduled Bank of Bangladesh in accordance with ITT Clause 35 & 36]

Invitation for Tender No: Date:

Tender Package No:

To:

Superintending Engineer (Grid & Sub-Station),
Bangladesh Rural Electrification Board

TENDER GUARANTEE No:

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

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

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

a. has withdrawn its Tender after opening of Tenders but within the validity of the Tender Security; or
b. refused to accept the Notification of Award (NOA) within the period as stated under ITT; or
c. failed to furnish Performance Security within the period 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 as stated under ITT.

This guarantee will expire

(a) if the Tenderer is the successful Tenderer, upon our receipt of a copy of the Contract Agreement signed by the Tenderer or a copy of the Performance Security issued to you in accordance with the ITT; or
(b) if the Tenderer is not the successful Tenderer, twenty eight (28) days after the expiration of the Tenderer's Tender validity period, 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.

Signature Signature

Notification of Award (Form PW3-7)

Contract No: Date:
To:

[Name of Contractor]

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

You are 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 63.1

ii. furnish a Performance Security in the form as specified and in the amount of Tk [state amount in figures and words] ,within fourteen (14) days of acceptance of this Notification of Award but not later than (specify date), in accordance with ITT Clause 65.

iii. sign the Contract within twenty eight (28) days of issuance of this Notification of Award but not later than (specify date), in accordance with ITT Sub Clause 69.2.

You may proceed with the execution of the Works 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
Superintending Engineer (Grid & Sub-Station),
Bangladesh Rural Electrification Board
Address: **Superintending Engineer**
(Grid & Sub-Station),
BREB- Training Academy Bhaban, 4th Floor,
Nikunja-2, Dhaka-1229.

Telephone: 88-02-58955524
E-mail no: gtd_rebdhk@yahoo.com

Date:

Contract Agreement (Form PW3-8)

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

WHEREAS the Procuring Entity invited Tenders for certain works, viz, [brief description of works] and has accepted a Tender by the Contractor for the execution of those works in the sum of Taka [Contract price in figures and in words] (hereinafter called “the Contract Price”).

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

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

2. The documents forming the Contract shall be interpreted in the following order of priority:
   (a) the signed Contract Agreement
   (b) the Notification of Award
   (c) the completed Tender and the appendices to the Tender
   (d) the Particular Conditions of Contract
   (e) the General Conditions of Contract
   (f) the Technical Specifications
   (g) the General Specifications
   (h) the Drawings
   (i) the priced Bill of Quantities and the Schedules
   (j) any other document listed in the PCC forming part of the Contract.

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

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

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

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

Bank Guarantee for Performance Security (Form PW3-9)

[This is the format for the Performance Security to be issued by a scheduled bank of Bangladesh in accordance with ITT Clause 64, 65, 66 & 67]

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

To:

Superintending Engineer (Grid & Sub-Station),
Bangladesh Rural Electrification Board

PERFORMANCE GUARANTEE No:

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

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

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

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

Signature Signature

Bank Guarantee for Advance Payment (Form PW3-10)

[This is the format for the Advance Payment Guarantee to be issued by a scheduled bank of Bangladesh in accordance with GCC Clause 75]

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

To:

[insert Name and address of the Procuring Entity].....

ADVANCE PAYMENT GUARANTEE No:

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

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

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

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

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

Signature Signature

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

[This is the format for the Retention Money Guarantee to be issued by a scheduled bank of Bangladesh in accordance with GCC Sub Clause 72.3]

Demand Guarantee

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

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

Date: [insert date.....]

RETENTION MONEY GUARANTEE No.: [insert number]

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

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

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

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

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

Signature Signature

SECTION-6 : BILL OF QUANTITY (BOQ)

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33 KV BAY-BREAKER EXTENSION WORK AT 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

Sl. No.	Description of Work	Unit	Qty	Unit Price (Lac Tk.)	Total Price (Lac Tk.)
A1.	**Costs of Equipment**				
1	Supply and Installation of Galvanized Steel Gantry Structure with all necessary accessories for installation of equipment- CT, PT, DS, PI, VCB mounting handle, metering arrangement, bus- bar , grounding all complete as per approved design & drawing and instruction of Engineer-in-charge.	LS	1		
2	Supply and Installation of 33kV, VCB (1250A, 31.5KA, 3sec) with interrupter unit, tripping coil, closing coil including anti pumping features with all necessary structures along with control panel including Instantaneous Overcurrent relay, Overcurrent relay IDMT, Earth fault relay IDMT and completely individual Analog Amp-meter, Analog Voltmeter, Analog Wattmeter, Analog Power Factor meter, Analog Watthour meter visible on the control panel for operation purpose as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	7		
3	Supply and Installation of Energy Metering Panel with 7 nos. energy meters (Programmable) having Space Provision for installation of 10 nos. energy meters including accuracy class-0.2, load profile, instrumentation profile for Minimum 6 months, software for protection and optical probe for data download as per IEC with Provision of Communication port for Automatic Meter Reading (AMR) as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	1		
4	Supply and Installation of 33kV, Single Phase Lightning Arrestor (Station Class), 10KA as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	21		
5	Supply and Installation of Bus-isolator (2500A, 31.5kA) without earth Blade for connecting existing and new bus-bar as per approved design & drawing and instruction of Engineer-in-charge.	Sets	1		
6	Supply and Installation of 33kV, Isolator (1250A, 31.5kA) without Earth Blade for circuits with operating box as per approved design & drawing and instruction of Engineer-in-charge.	Sets	7		
7	Supply and Installation of 33kV, Isolator (1250A, 31.5kA) with Earth Blade for Feeder with operating box. as per approved design & drawing and instruction of Engineer-in-charge.	Sets	7		
8	Supply and Installation of 33kV Single Phase Current Transformer, (800-400: 5-5-5A, 0.2, 30VA for core-1 indicating meters on control panel & (800-400: 5-5-5A, 0.2, 30VA for core-2 for energy meters on separate metering panel and 800-400: 5-5-5A,5P20, 30VA for protection) as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	21		
9	Supply of 33kV, Single Phase Voltage Transformer (Secondary winding for core-1 accuracy class-0.2, capacity 60VA dedicated for metering and for core-2 accuracy class 3P, capacity 60 VA) as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Nos.	3		
10	Supply and installation of 33kV Drop out Fuse Isolator for 33/0.4kV for 200KVA Auxiliary Transformer as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Sets	1		
11	Supply and installation of 110V Battery & Battery Charger with additional 5 nos battery cell as spares as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Set	1		
12	Supply and installation of 33/0.4kV Auxiliary 200 kVA Transformer with 0.415kV, 4c×120 mm^ Power Cable and accessoriesas per approved design & drawing and instruction of Engineer-in-charge /Employer.	Nos	1		
13	Supply and installation of Miscellaneous equipment including multicore control cables required for works, ACDB, DCDB, earthing materials to match with existing PGCB Grid Sub-Station, MK Box, sub-station lighting and 33 kV Bus-bar (2x Martine) including loop conductor & Connector, Insulator & other related required fittings etc as per approved design & drawing and instruction of Engineer-in-charge.	LS	LS		

14	Testing & commissioning of all Equipment complete, etc.	LS	LS		
	Sub total cost A1 for Electrical Part of Bay-Breaker Extension work				
A2	**Costs of Civil Works**				
15	Site Development /Improvement by carted/dredged earth or sand (free from any organic, foreign, environmental hazards substances) carried by head or truck or any other means cost of cutting or dredging of earth or sand , carrying placing, the earth or sand including piling back filling, Roads, beautification etc.Mechanical compaction of earth or sand in 150mm layers including leveling, watering and consolidation each layer with chain dozer, grader, roller etc. to achieve minimum dry density of 90% with optimum moisture content (modified protor test) up to finished level all complete and accepted by the engineer subject to submission of the method statement.	Cum	450		
16	Supply materials and construction of Two storied Control Room Building (12mx10m) as per approved design & drawing and direction of Engineer-in-charge.	sqm	240		
17	Supply materials and Construction of Foundation of all Equipments and gantry Structure as per approved design & drawing and direction of Engineer-in-charge.	LS	LS		
18	Surface Finishing with gravels for new bay-breaker extension area as per approved design & drawing and direction of Engineer-in-charge.	sqm	280		
19	Supply materials and construction of internal road as per approved design and drawing and direction of the engineer in charge	sqm	80		
20	Supply materials and construction of surface drain as per approved design and drawing and direction of the Engineer in charge.	Rm	80		
21	Supply materials and construction of RCC Control Cable Trench for cable laying as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Rm	177		
22	Furniture and well furnished Control Room building for Office Room,Complain Center, Rest room (3 nos. executive table, 2 nos. executive chair, 12 nos. visiting chair, 2 nos. file cabinate, 3 nos. file rake, 2 set (5 seated sofa), 1 set computer table & chair. 2 nos, almira and as required) as per approved design & drawing and instruction of Engineer-in charge /Employer.	L.S	L.S		
23	Air Conditioning System (each 2 Ton) for Control Room including all accessories/ components required for fitting & fixing up to commissioning as per approved design & drawing and instruction of Engineer-in-charge /Employer.	No.	4		
24	Desktop Computer including all accessories/ components as per approved design & drawing and instruction of Engineer-in-charge /Employer.	No.	1		
25	Laptop Computer including all accessories/ components as per approved design & drawing and instruction of Engineer-in-charge /Employer.	No.	1		
26	Supply of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect) as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Set	1		
27	Supply of Fire Detection & Protection Facilities for control room building including all accessories/ components required for fitting & fixing up to Commissioning as per approved design & drawing and instruction of Engineer-in-charge /Employer.	L.S	1		
	Sub total cost A2 for Civil Part of Bay-Breaker Extension work				
A3	**Spare Parts**	LS	LS		
28	Supply of Spare parts for future maintenance workss per approved design & drawing and instruction of Engineer-in-charge /Employer.				
	Total Estimated cost for Bagerhat 33 kV Bay- Breaker Extension work A=(A1+A2+A3)				

In word:

Note: 1. All Costs of Equipment shall include Design. Manufacture, Transportation to site including Insurance, VAT & all other Taxes (as applicable in the Employer's Country)

2. All Costs of Works shall include Cost of Works including Insurance, VAT income Tax & all other Taxes (as applicable in the Employer's Country).

SECTION-6 : BILL OF QUANTITY FOR SPARE PARTS (BOQ)

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33 KV BAY-BREAKER EXTENSION WORK AT 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

Sl. No.	Description of Work	Unit	Qty	Unit Price (Lac Tk.)	Total Price (Lac Tk.)
1	Supply of Pole of 33kV VCB (1250A, 31.5kA, 3 sec) as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	6		
2	Supply of Circuit Breaker Closing Coil (offered type) as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	6		
3	Supply of Circuit Breaker Tripping Coil (offered type) as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	6		
4	Supply of 33kV Single Phase Lightning Arrestor (Station Class), 10KAas per approved design & drawing and instruction of Engineer-in-charge.	No	6		
5	Supply of 33kV Single Phase Current Transformer, (800-400: 5-5-5A, 0.2, 30VA for core-1 indicating meters on control panel & (800-400: 5-5-5A, 0.2, 30VA for core-2 for energy meters on separate metering panel and 800-400: 5-5-5A,5P20, 30VA for protection) as per approved design & drawing and instruction of Engineer-in-charge.	Nos.	3		
6	Supply of 33kV, Single Phase Voltage Transformer (Secondary winding for core-1 accuracy class-0.2, capacity 60 VA dedicated for metering and for core-2 accuracy class 3P, capacity 60 VA) as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Nos.	3		
7	Relay micon-122	Nos.	2		
	Total Estimated cost for Spare parts under Turnkey Contract.				

In word:

Note: 1. All Costs of spares shall include Design, Manufacture, Transportation to site including Insurance, VAT & all other Taxes (as applicable in the Employer's Country).

2. All Costs of Works shall include Cost of Works including Insurance, VAT income Tax & all other Taxes (as applicable in the Employer's Country).

3. All costs shall include the items / components as detailed in the document

4. The dimension of Bay width, Equipment to Equipment distance and equipment height all shall be matched with existing structure of 132/33KV PGCB GRID SUB-STATION.

Seal and signature of Tenderer

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

TENDER DOCUMENT
FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

VOLUME 2 OF 3

SCOPE OF WORKS

SECTION :7 - GENERAL SPECIFICATION

Contents

1.0 EMPLOYER'S REQUIREMENTS 13

1.1 General 13

1.2 Description of work 13

1.3 The work- 33kv Bay-Breaker Extension at Bagerhat Grid Sub-station .. 13

2.0 PROJECT REQUIRMENTS 16

2.1 RESTRICTED WORKING PERIOD 16

2.2 SYSTEM ELECTRICAL PARAMETERS 16

2.3 CLIMATIC CONDITIONS 16

2.4 TERMINAL POINTS 17

3.0 DEFINITE WORKS: 18

3.1 Bagerhat 33 kV Bay-breaker extension work: 18

4.0 GENERAL TECHNICAL REQUIREMENTS 21

4.2 INSTRUCTION MANUALS 22

4.3 DESIGN AND CONSTRUCTION REQUIREMENTS AND INTERCHANGEABILITY 22

4.4 UNITS OF MEASUREMENT 24

4.5 PLANT AND EQUIPMENT IDENTIFICATION 24

4.6 SAFETY AND SECURITY 25

4.7 VIBRATION AND BALANCE 28

Operating Synchronous ..... Vibration Amplitude .28

4.8 OUTDOOR PLANT RATING, WEATHER PROTECTION AND SUNSHADES 29

4.9 PACKING AND MARKING 30

4.11 SPARE PARTS 35

4.12 CONSUMABLE ITEMS 36

4.14 GALVANIZED WORK 39

4.15 CHROMIUM PLATING 40

4.16 MECHANICAL ITEMS 40

4.17 CURRENT RATINGS 44

4.18 VOLTAGE RATINGS 45

4.19 L.V. CIRCUIT PROTECTION 46

4.20 CURRENT TRANSFORMERS (CTs). 47
4.21 VOLTAGE TRANSFORMERS (VTs) 48
4.22 ELECTRICAL EQUIPMENT, INSTRUMENTS AND METERS 49
4.23 CONTROL AND SELECTOR SWITCHES 50
4.24 AUXILIARY SWITCHES 51
4.25 TRANSISTORIZED ELECTRONIC EQUIPMENT 52
4.26 ALARM EQUIPMENT 52
4.27 PANELS, DESKS, KIOSKS AND CUBICLES 54
4.27.2 Indicating Lamps 55
4.27.3 Anti-Condensation Heaters 56
4.28 PANEL WIRING AND TERMINAL BOARDS 57
4.30 CONDUIT AND ACCESSORIES 60
4.31 TRUNKING 61
4.32 ELECTRIC MOTORS 61
4.33 MOTORS STARTERS AND CONTACTORS FOR SEPARATE MOUNTING 64
4.34 PUSH-BUTTONS AND SEPARATELY MOUNTED PUSH-BUTTON STATIONS 65
4.35 PORTABLE FIREFIGHTING APPARATUS 65
4.36 STANDARDS 66
4.37 NOMINAL SAFTY CLEARANCE 66
5.0 SPECIFICATION OF SWITCHGEAR AND ASSOCIATED EQUIPMENT 66
5.1 33KV OUTDOOR TYPE CIRCUIT BREAKERS 66
5.1.8 SPECIFICATION OF OUTDOOR 33 kV SWITCHGEAR 72
5.2 33 kV Current Transformer 73
5.3 33 kV Lightning Arrester 73
5.4 33 kV Isolator, Off Load Type (Outdoor) 73
5.5 33 kV Isolator with Earthing Blade for Bus and Line Side (Outdoor) 74
5.6 33 kV Voltage Transformer 74
5.7 33/0.4KV, 100KVA OUTDOOR AUXILIARY TRANSFORMERS 75
5.8 LV AC Distribution Panel 75
5.9 DC Distribution Panel, Battery set and Battery Charger (110v) 76
5.10 CONTROL ALARMS PROTECTION & METERING 85
5.11 EARTHING SYSTEMS AND LIGHTNING PROTECTION 93
5.12 SUPPORTING STRUCTURES FOR OUTDOOR EQUIPMENT 105
Load Combination 1-Design Wind, Coincident Temperature, (Ice)B 106
5.13 MATERIALS 109
5.14 WORKMANSHIP 110

5.15 PROTECTIVE TREATMENT 110
5.16 QUALITY CONTROL 110
5.17. CIVIL AND BUILDING WORKS 113

1.0 EMPLOYER'S REQUIREMENTS

1.1 General

Power Grid Company of Bangladesh (PGCB) constructed a 132/33kV, 25/41MVA grid sub-station at Bagerhat under Bagerhat district. The **Superintending Engineer (Grid & Sub-Station)**, BREB, Dhaka. intends to extend the 33kV Bay at Bagerhat grid sub-station to center load through its distribution system in and around Bagerhat as Turn-Key Contract. The detailed scope of work stipulated under this turn key contract is described in the following pages.

1.2 Description of work

The Work covered by the Specification is outlined below, for design, supply and construction of 4 nos. 33 kV Bay extension with Seven (07) nos. 33 kV outgoing feeders.

The Contract includes for the design, manufacture, quality assurance, inspection and testing, packing for export, insurance and shipment to site, completed construction and installation, jointing, terminating, bonding, earthing, painting, setting to work, site testing and commissioning of the Work.

The extent of the works is described broadly in the schedules and shown on the drawings forming part of this specification. The contract is of the "turnkey" type in which the Contractor is responsible for ensuring that all and any items of work required for the safe, efficient and satisfactory completion and functioning of the Works, are included in the Tender Price whether they be described in the Specification or not.

For the purpose of evaluation, time for completion, etc. in accordance with the general condition of contract the following works are to be carried out.

1.3 The work- 33kv Bay-Breaker Extension at Bagerhat Grid Sub-station

The 33kV Bay-breaker Extension work comprising construction of 04 nos. 33 kV Bay for 07 nos. 33 kV outgoing feeder at Bagerhat 33 kV switchyard in 132/33 kV Sub-Station including installation of new Bus-bar (2500A). 07 outgoing feeders control panels will be installed in the existing control room building. Supply materials and construction of foundation for gantry structure and all equipments foundation, Power cable & Control cable trench, Surface finishing with gravels for new Bay-breaker extension area and internal RCC Road. The salient features of Bay extension work are furnished below:

Sl. No.	Description of Work	Unit	Qty
A1.	**Scope of Electrical Equipments**		
1	Supply and Installation of Galvanized Steel Gantry Structure with all necessary accessories for installation of equipment- CT, PT, DS, PI, VCB mounting handle, metering arrangement, bus- bar , grounding all complete.	LS	1

2	Supply and Installation of 33kV, VCB (1250A, 31.5KA, 3sec) with interrupter unit, tripping coil, closing coil including anti pumping features with all necessary structures along with control panel including Instantaneous Overcurrent relay, Overcurrent relay IDMT, Earth fault relay IDMT and completely individual Analog Amp-meter, Analog Voltmeter, Analog Wattmeter, Analog Power Factor meter, Analog Watthour meter visible on the control panel for operation purpose.	Nos.	7
3	Supply and Installation of Energy Metering Panel with 7 nos. energy meters (Programmable) having Space Provision for installation of 10 nos. energy meters including accuracy class-0.2, load profile, instrumentation profile for Minimum 6 months, software for protection and optical probe for data download.	Nos.	1
4	Supply and Installation of 33kV, Single Phase Lightning Arrestor (Station Class), 10KA .	Nos.	21
5	Supply and Installation of Bus-isolator (2500A, 31.5kA) without earth Blade for connecting existing and new bus-bar .	Sets	1
6	Supply and Installation of 33kV, Isolator (1250A, 31.5kA) without Earth Blade for circuits with operating box.	Sets	7
7	Supply and Installation of 33kV, Isolator (1250A, 31.5kA) with Earth Blade for Feeder with operating box.	Sets	7
8	Supply and Installation of 33kV Single Phase Current Transformer, (800-400: 5-5-5A, 0.2, 30VA for core-1 indicating meters on control panel & (800-400: 5-5-5A, 0.2, 30VA for core-2 for energy meters on separate metering panel and 800-400: 5-5-5A,5P20, 30VA for protection)	Nos.	21
9	Supply of 33kV, Single Phase Voltage Transformer (Secondary winding for core-1 accuracy class-0.2, capacity 60VA dedicated for metering and for core-2 accuracy class 3P, capacity 60 VA) as per approved design & drawing and instruction of Engineer-in-charge /Employer.	Nos.	3
10	Supply and installation of 33kV Drop out Fuse Isolator for 33/0.4kV for 200KVA Auxiliary Transformer.	Sets	1
11	Supply and installation of 110V Battery & Battery Charger with additional 5 nos battery cell as spares.	Set	1
12	Supply and installation of 33/0.4kV Auxiliary 200 kVA Transformer with 0.415kV, 4c×120 mm^ Power Cable and accessoriesas per approved design & drawing and instruction of Engineer-in-charge /Employer.	Nos	1
13	Supply and installation of Miscellaneous equipment including multicore control cables required for works, ACDB, DCDB, earthing materials to match with existing PGCB Grid Sub-Station, MK Box, sub-station lighting and 33 kV Bus-bar (2x Martine) including loop conductor & Connector, Insulator & other related required fittings etc.	LS	LS
14	Testing & commissioning of all Equipment complete, etc.	LS	LS
A2	**Scope of Civil Works**		
15	Site Development /Improvement by carted/dredged earth or sand (free from any organic, foreign, environmental hazards substances) carried by head or truck or any other means cost of cutting or dredging of earth or sand , carrying placing, the earth or sand including piling back filling, Roads, beautification etc.Mechanical compaction of earth or sand in 150mm layers including leveling, watering and consolidation each layer with chain dozer, grader, roller etc. to achieve minimum dry density of 90% with optimum moisture content (modified protor test) up to finished level all complete and accepted by the engineer subject to submission of the method statement.	Cum	450
16	Supply materials and construction of Two storied Control Room Building (12mx10m) .	sqm	240
17	Supply materials and Construction of Foundation of all Equipments and gantry Structure.	LS	LS
18	Surface Finishing with gravels for new bay-breaker extension area.	sqm	280
19	Supply materials and construction of internal road.	sqm	80
20	Supply materials and construction of surface drain.	Rm	80
21	Supply materials and construction of RCC Control Cable Trench for cable laying	Rm	177

22	Furniture and well furnished Control Room building for Office Room,Complain Center, Rest room (3 nos. executive table, 2 nos. executive chair, 12 nos. visiting chair, 2 nos. file cabinate, 3 nos. file rake, 2 set (5 seated sofa), 1 set computer table & chair. 2 nos, almira and as required)	L.S	L.S
23	Air Conditioning System (each 2 Ton) for Control Room including all accessories/ components required for fitting & fixing up to commissioning.	No.	4
24	Desktop Computer including all accessories/ components.	No.	1
25	Laptop Computer including all accessories/ components.	No.	1
26	Supply of water Pump Motor Set including all accessories/ components required for fitting & fixing up to Commissioning (complete in all respect).	Set	1
27	Supply of Fire Detection & Protection Facilities for control room building including all accessories/ components required for fitting & fixing up to Commissioning.	L.S	1
28	Supply of Spare parts for future maintenance works.		

All Civil works needed are to be carried out.

The specifications for equipment, material and workmanship are enclosed herewith. In addition to the specifications, the followings are to be added as part of specification:

i) Relay:

All relay should be static/numerical type, Siemens (Germany), Alstom (UK/France) or ABB (Switzerland/Sweden) make.

ii) Meters:

All meters should be of Simens (Germany/Switzerland), Alstom (UK), ABB Switzerland), AEG (Germany), Schlumberg (USA) make.

Substation Earthing:

The earth mesh in the 132kV sub-station was designed and constructed by Siemens (PGCB) and the same design shall be used in the 33kV switching station.

However, equipotential earthing mesh should be provided in the switching station. The earthing mash design should be based on safe step and touch voltage for average 50 kg body weight. To minimize step voltage crushed stone shall be used.

The General Single Line Diagram of 33kV switching station is enclosed with this document. The enclosed drawings are indicative only and the number of breakers and other equipment will be as per Bill of Equipment/Material/Work or as required to complete the work.

2.0 PROJECT REQUIRMENTS

2.1 RESTRICTED WORKING PERIOD

Due to flooding, construction work in some areas may only be possible during a period roughly from November to May. The Contractor shall obtain reliable information concerning the conditions appertaining to the working areas covered by this Contract and shall plan his work in accordance with local conditions.

2.2 SYSTEM ELECTRICAL PARAMETERS

2.2.1 33 kV Transmission System

System Voltage	...	33	kV
Rated Voltage	...	36	kV
Impulse Voltage Withstand Level	...	170	kV
Number of Phase	...	3	
Frequency	...	50	Hz
Switchgear Symmetrical Breaking Capacity	...	31.5	kA, 3 sec

The 33 kV system shall be solidly earthed as in the 132/33 kV Grid substation.

2.2.2 Low Voltage AC System

Normal Service Voltage	...	400/230	volts
Rated Voltage	...	415/240	volts
Number of Phase	...	3 phase 4 wire	
Frequency	...	50Hz	
Switchgear Symmetrical Breaking Capacity	...	31.5kA, 3 sec	
System earthing	…	Solidly earthed	

2.2.3 D.C System

D.C. auxiliaries, tripping, indicating lamps and controls.

Normal battery voltage	...	110V nominal
Tolerance on rated voltage	...	± 10%

2.3 CLIMATIC CONDITIONS

All plant and equipment supplied under the Contract shall be entirely suitable for the climatic conditions prevailing at site.

The area of the Bagerhat PBS is close to sea level and is in a tropical climate. The ambient shade temperature variation is between 5^0C and 45^0C with periods of high humidity.

Between May and November low lying areas are subject to flooding.

Bagerhat district area is designated a zone of moderate intensity for earthquakes.

The seismic factor is mentioned is Bangladesh National Building Code (BNBC).

Atmospheric pollution is low and special insulator design or washing is not required. The area is subject to high winds of typhoon strength.

Maximum ambient shade temperature	...	45^0C
Minimum ambient shade temperature	...	5^0C
Maximum daily average temperature	...	35^0C
Maximum annual average temperature	...	25^0C
Maximum wind velocity (3 second gust)	...	160 Km/h
Minimum wind velocity for line rating purposes	...	1.6/3.2 Km/h (33/132kV)
Solar radiation	...	100mW/sq. cm
Rainfall	...	2.5 m/annum
Relative humidity, maximum	...	100%
average	...	90%
Altitude	...	less than 150m
(No ice or snow expected)		
Atmospheric Pollution	...	mid level
Soil type	...	alluvial
Soil temperature (at 1.1m)	...	30^0C
Soil thermal resistivity	...	1.5^0C m/w
Isokeraunic Level (Thunderstorm days)	...	80

The information in this Clause is given solely for the general assistance of Tenderers and no responsibility for it will be accepted nor will any claim based on this Clause be considered.

2.4 TERMINAL POINTS

2.4.1 <u>33 kV, Primary overhead Line Circuit Connections</u>

The slack spans including overhead earth wires between the over head terminal towers at the existing PGCB 132/33kV sub-station structure and the 33kV switching station structure will be supplied and terminated by the Contractor. Eyebolts or other suitable fixtures for terminating the slack spans on the switchyard gantry shall be provided on this Contract.

The Contractor will provide a jumper from the slack span of sufficient length to terminate on the sub-station entry equipment. The supply of appropriate clamps and the actual termination of the jumper to the sub-station equipment shall be carried out under this Contract.

Bonding of the incoming earth wire to the station earthing screen and supply of earthing conductor and connection of the terminal tower earth electrode into the sub-station earth grid shall be carried out under this Contract.

Power and multicore Cabling between sub-station Equipment, interconnecting to the marshalling cubicles, LV, AC and DC, etc. within 33 kV switching station and cabling between equipment and control room shall be installed, terminated and tested under this Contract.

2.4.2 <u>Civil Works</u>

The civil works on this Contract shall include site development, construction of two storied control room building with 03 storied foundation, RCC Power cable and Control cable trench, Foundation of Gantry structure and equipments, surface finishing with gravels, internal roads, surface drains & apron (if applicable) etc. as per requirements for complete of Bay-extension work and approved design & Drawing and instruction of BREB Employers.

3.0 DEFINITE WORKS:

3.1 Bagerhat 33 kV Bay-breaker extension work:

The 33kV Bay-breaker Extension work comprising construction of 02 no. 33 kV Bay for 04 nos. 33 kV outgoing feeder at Bagerhat 33 kV switchyard in 132/33 kV Sub-Station including dismantling of existing 33 kV Bus-bar and installation of new Bus-bar (2500A). 04 outgoing feeders control panels will be installed in the existing control room building. Supply materials and construction of foundation for gantry structure and all equipments foundation, Power cable & Control cable trench, Surface finishing with gravels for new Bay-breaker extension area and internal RCC Road. and testing & commissioning etc. as per approved design & drawing and instruction of Engineer-in-charge /Employer.

Grounding grid (mesh) will have be designed and implemented covering the area of the 33kV switching station/ Bay-breaker extension work following the design of 132kV sub-station area done by PGCB.

The following data/condition will be considered in designing the mesh.

1. Max. fault current at 33 kV – 31.5 kA
2. Fault clearing time - 3 sec.
3. Area coverage of the premises - as per layout.

4a Resistivity of the soil-30 ohm meter (for bidding purpose only). Before designing the mesh the bidder should follow the field measurement done by PGCB.

4b Resistivity of the top surface of concrete pavement = 3000 ohm meter.

5. Depth of the ground grid conductor below the switchyard surface = 0.6 m.
6. Grid conductor is round stranded annealed copper wire of 150 mm^2 cross section (for bidding purpose only). Grounding design calculation (IEEE standard 80) will determine the actual size.
7. Grounding rods where required will be connected to different equipment as well as to the earthing grid.

A list of the salient equipment and materials to be supplied in this work is given below:

a) Steel structure for 2 bay excluding existing bays.	LS
b) 33kV outdoor circuit breakers for existing incoming feeders (2000A) with control panels (N/A)	-
c) 33kV outdoor circuit breakers for outgoing feeders (1250A) with control panels	07 Sets
d) Separate energy metering panel with 04 nos energy meter	1 no.
e) Remove & re-installation of 33/0.4kV, 200 kVA, auxiliary transformer (N/A)	01 no
f) Installation of 33/0.4kV, 200 kVA, auxiliary transformer (N/A)	-
g)33kV disconnecting switch without earth blade for bus section isolator (2500A)	2 sets
g) 33kV disconnecting switch with earth blade for incoming feeders (2000 A) (N/A)	-
h) 33kV disconnecting switch without earth blade for outgoing feeders (1250 A)	7 Sets
i) 33kV disconnecting switch with earth blade for outgoing feeders (1250 A)	7 Sets
j) 33kV single phase CT for incoming feeders (N/A)	03 nos.
k) 33kV single phase CT for outgoing feeders	21 nos.
l) 33kV single phase PT at bus - If applicable	As per Tech. Req.
m) 33kV single phase lightning arrestors	As per Tech. Req.
n) Suspension/tension insulator string for 33kV	01 set
o) Bus insulators for 33kV	01 set
p) Battery 110V	--
q) Battery chargers 110V	-
r) DC distribution board with volt and ampere meters & MCBs (if required)	LS
s) 415V AC distribution board with volt, ampere and energy meters & MCCBs (if required)	LS
t) Power cables	LS
u) Control cables	LS
v) Cable tray	LS
w) Copper conductors (150mm^2) for earthing	LS
x) Bus conductor (2xMartine) of rating 2500A	

Design, manufacture, factory testing, carrying & handling upto the port of export, marine insurance and shipment, local transportation, erection all other related works including testing & commissioning on turnkey basis are within the scope of work.

The enclosed single line diagram of the proposed switching station will indicate the scope of work to be done. A site layout drawing is also enclosed to check the probable location of the switchyard, control room buildings etc. and the work involvement.

The location of the control panels and the route of the cable trench are shown in the layout plan of the control room. The size and position of the cable trench shown in the drawing will be constructed as per requirement. The cable trench will have its bed 150 mm thick C.C. work and wall of 250 mm thick brick construction in cement mortar. The bed will have slope for drainage of water. Appropriate luminaries, fan (Pedestal) power sockets shall be fitted. The control cables will enter into the ground floor of the control building through the DUCT kept for the control cables. The control panels will be installed at a height of about 300mm above the floor level. The control cables from the duct will pass through the path out side the control room and pass through the bottom of the control panels. Operational control of 33 kV circuit breakers in the switchyard will be controlled & monitored from the control room. Necessary connection by appropriate size of conductor/control cable is to be made for functioning metering, recording etc. of the switching station. The size and position of control panels, battery charger, AC/DC panels etc. are shown in the control room layout plan. A separate panel for the energy meters for the outgoing feeders will be installed in the control room. The size and position of the cable trench along with the location of the circuit breaker, isolator, CT, VT, LA, auxiliary transformers inside the 33kV switching station will be constructed as per requirement.

Concrete road and gate along with a guard house will be constructed for easy access to the control room building and the switchyard and for transportation of equipment.

The contractor shall have to construct all foundations in the switchyard for steel structures such as circuit breakers, isolators, CT, VT, Auxiliary transformers etc. as per design duly approved by the Employer.

All the low voltage cables (Viz. control, signaling, power, CT & VT cables etc) required to connect the transformers to the control/energy meter panels situated at the control room, shall be laid on galvanized steel / aluminium trays on the supporting brackets placed at appropriate intervals (about 3m) and fixed on the wall on the cable trench at a depth of about 300 mm from the top. The connections at both ends i.e. the switchgear end and control/relay panel end shall be done on appropriate terminal strips with numbering etc. as per advice of the Employer. The 100 kVA Station transformers (2 nos.) will be pad mounted.

Metallic trays if required may be installed in the space out side the control room for carrying the control/LV cables to be terminated to various equipment/panels installed at the ground floor.

The equipment's panels, etc. shall be installed at the locations/rooms indicated in the layout drawing and appropriate cable trenches/cable trays shall be made as required as per advice of the Employer. Even the locations of the equipment's/panels may be changed for convenience as per advice of the Employer.

Grounding rods will be planted at appropriate locations as per advice of the Employer and the connections of the grounding with the equipment/structures shall be made using recommended copper conductor/copper bar and appropriate connectors.

The covers of the cable trench in the switchyard shall be with RCC construction with suitable size & weight for easy handling.

The internal illumination of the new control room building along with the outdoor switchyard, the approach roads, areas near the boundaries etc. shall be done under this contract. For outdoor, general illumination will be done by sodium light to get rid of the insects.

The recommended illumination levels may be given as follows:

	Description	**Illumination Level (minimum)**
1.	Control/Relay room/Office room	400 Lux.
2.	Switch room	200 Lux.
3.	Other misc. rooms Viz. battery, etc.	100 Lux.
4.	Toilet	100 Lux.
5.	Corridor	100 Lux.
6.	Outdoor switchyard, approach road boundary etc.	20 Lux.
7.	Flood light to focus on Transformer Isolator, breaker etc.	200 Lux.
8.	Perimeter lighting	10 Lux.

The LV AC input from the station Transformer (2×100 KVA) will come to AC distribution panel by 2×95mm^2 4 core LV power cable (PVC insulated) and from there, the AC power will be distributed all throughout the Switching Station (only for station use). The distribution system will be developed by the Tenderer and approved by the Employer. The LV AC panel will be provided with ammeter, volt meter and two energy meters for the two station transformers.

Electrical wiring of the new control room buildings shall be done on covered trays fitted on the surface of the wall and standard switch board, switches, fittings, sockets MCCB's shall be used. Fittings of the luminaries, fans, exhaust fans (where required) are to be provided. Split type air conditioner with condenser fitted on the roof shall be provided. There shall be three independent units each of capacity 75% of the total requirements for cooling of the control room & office for standard cooling/moisture content levels. Additional points/outlets in the AC distribution panel shall be kept to provide connection to any equipment as & where required.

4.0 GENERAL TECHNICAL REQUIREMENTS

CIVIL AND BUILDING WORKS

The requirements for the buildings, foundations and other civil works are described in this Specification.

Where items of mechanical plant are mounted on foundations, which are part of the civil engineering works, the Contractor shall carry out suitable leveling and adjustment of the plant on the civil foundations, before the plant is secured in position. The Contractor shall check the alignment, leveling or positioning of the mechanical plant in question, before and after grouping. The Contractor shall make records of the alignment, leveling or positional measurement and shall maintain such records until his activities at site are concluded.

4.2 INSTRUCTION MANUALS

The Contractor shall provide the Employer with complete and detailed instruction manuals covering the operation and maintenance of the Plant, as detailed in this Specification.

4.3 DESIGN AND CONSTRUCTION REQUIREMENTS AND INTERCHANGEABILITY

4.3.1 General Requirements

The Works shall be designed to operate safely, reliably and efficiently in accordance with the Design and Operating Requirements stated in this Specification.

No departure from the Specification shall be made subsequent to the Contract without the written approval of the Employer.

In the event of there being any direct conflict in the technical requirements specified in the various parts of this Specifications, the following hierarchy shall apply, with the sections of the Specification first listed taking precedence over the sections later in the list:
The overall plant performance requirements are specified in the Schedules; the detailed technical specification for the relevant part of the works contained in the specific Section of the specification; the general requirements of the Specification.

In the event that the Contractor detects, when preparing designs to national or international standards or codes for boilers, pipe work, electrical equipment or civil works, that the specification is in conflict with the standard or code, he shall immediately contact the Employer to draw attention to the anomaly and, unless instructed otherwise by the Employer within twenty one days, shall proceed with the works on the basis of the requirements of the national or international standard or code.

Particular attention must be paid to internal and external access in order to facilitate inspection, cleaning and maintenance. The Works shall be arranged such that each major item plant, or group of minor plant items, can be safely isolated from all hazards for maintenance, if necessary, whilst the remainder of the plant remains in service.

The design shall conform to the best current engineering practice. Each of the several parts of the Plant shall be of the maker's standard design, provided that this design is in general accordance with the Specification.

The design, dimensions and materials of all parts shall be such that they will not suffer damage as a result of stresses under the most severe service conditions. The materials used in the construction of the Plant shall be of the highest quality and selected particularly to meet the duties required of them. The plant shall be designed and constructed to minimize correction. Workmanship and general finish shall be of the highest class throughout.

All plant items and corresponding parts forming similar duties shall be interchangeable in order to minimize the stock of spare parts.

All equipment shall be designed to minimize the risk of fire and damage, which may be caused in the event of fire.

The equipment shall also be designed to prevent ingress of all vermin, accidental contact with live parts and minimize the ingress of dust and dirt.

4.3.2 Specific Requirements

The choice of plant and design of the installation is to meet the following criteria.

(a) Sub-station layouts are to utilize the minimum of land area.

(b) All equipment is to facilitate the installation of all circuits indicated as "future" with the minimum of disruption. All cabling schemes, D.C. and A.C. equipment etc. shall be designed to accommodate all such future circuits, loads, etc.

(c) The complete installation is to be designed, and plant selected, to require the minimum of maintenance. The minimum recommended maintenance period for any item of plant will be 12, months, for the service conditions on site.

(d) The plant and installation shall be designed for a minimum service life of 25 years.

(e) All plant is to have a minimum of 4 years satisfactory and proven service record of high durability and reliability in a similar environment. Documentary evidence in support of the choice of any item of plant will be provided by the Contractor if requested by the Employer.

(f) The arrangement and design of the installations shall permit all inspection and maintenance, either preventative or corrective, to be performed with the minimum of disturbance to other plant. The minimum of special tools, handling equipment or specialist test equipment is to be required for the overhaul or maintenance of the plant.

(g) The sub-station is to be designed such that the failure or removal of any one item of plant for maintenance or repair shall not impair the operational integrity of the sub-station.

(h) The design and layout of the sub-stations shall ensure the safety of personnel concerned with the operation and maintenance of the plant.

(i) For outdoor switchyards where future, or spare circuits fall within the span of busbar runs provided, these circuits are to be provided with busbar disconnectors connected to the busbar within the contract price.

(j) Auxiliary transformers are to be adequately rated to supply all the simultaneous sub-station loadings, including for all future circuits and equipment plus the operation of oil treatment plant when required, plus 20% additional capacity with a minimum rating of 100 KVA.

4.4 UNITS OF MEASUREMENT

The Contract shall be conducted in the Systems International Units (SI) system of units in accordance with the provisions of ISO 31 and ISO 1000.

The bar (10^5 N/m^2) shall be adopted as the usual unit of pressure.

Pressures below 1 bar shall be expressed in milli bar

Pressures shall generally be expressed in absolute measurements and gauge (that is relative to atmospheric) pressures shall only be used where strictly necessary. Sub-atmospheric pressures shall normally be expressed as positive absolute pressures in millibars. If necessary to avoid misunderstanding, the pressure may be stated as bar a, for absolute and bar g. for gauge pressure respectively.

Rev/min shall be adopted as the unit of rotational frequency for rotating plant.

Flow rates shall generally be expressed in units of kg/sec or m^3/sec.

Masses shall be generally expressed in kg. or ton, where 1 ton-1000 kg.

4.5 PLANT AND EQUIPMENT IDENTIFICATION

4.5.1 Identification on Drawings

The Contractor shall prepare comprehensive Plant or Equipment identification Schedules. The Schedules shall include the respective flow sheet or Drawing/Diagram identification Numbers.

4.5.2 Labels and Nameplates

The Contractor shall supply and install all labels, name ratings, instruction and warning plates necessary for the identification and safe operation of the Works.

Nameplates of labels shall be non-hygroscopes material with engraved lettering of a contrasting color or, alternatively in the case of indoor circuit-breakers, starters, etc. of plastic material with suitably colored lettering engraved thereon. Items of Pant such as valves, mounted outdoors or subject to harsh operating conditions, shall be provided with engraved chromium plated brass or stainless steel nameplates or labels with engraving filled with black enamel.

All the above labels and plates shall be securely fixed to items of plant and equipment with stainless steel rivets, plated self tapping screws or other approved means. The use of adhesives will not be permitted.

The language of labels, plates and notices shall comply with the requirements of the Contract.

Individual plant items and all relevant areas within the contract works where a danger to personnel exists shall be provided with plentiful, prominent and clear warning notices.

These warning notices shall draw attention to the danger or risk with words which attract attention and summarize the type of risk or danger. The notices shall also carry a large symbol which graphically depicts the type of risk.

All equipment within panels and desks shall be individually identified. The identification shall correspond to that used in schematic and wiring diagrams.

Each circuit breaker panel, electrical control panel, relay panel etc., shall have circuit designation label mounted on the front and rear. Corridor type panels shall additionally have circuit designation labels within the panels.

All equipment and apparatus mounted there on shall be clearly labeled in an approved manner. The function of each relay, control switch, indicating lamp, mcb, link etc. shall be separately labeled.

Withdrawable relays, or items with can be detached from a base plate, or rack shall carry an identification label on both fixed and withdrawable portions. The identification shall correspond to that used in the associated schematic and wiring diagrams.

4.6 SAFETY AND SECURITY

4.6.1 General Noise Limits

The plant and equipment provided in accordance with this specification, shall either by its design and/or selection, or by additional sound absorbing enclosures supplied as part of this contract, meet the noise level requirements for both general work area limits, and neighborhood noise limits as specified herein.

The plant and equipment shall be deemed to meet the requirements of this specification if the noise levels measured, or calculated from measurements after background and other corrections have been applied, and after any appropriate tolerances have been allowed in accordance with the given standards do not exceed the noise limits specified.

The nomenclature, measurement and calculation procedures and the procedure for acceptance shall be in accordance with the Oil Companies Materials Association (OCMA) Noise Procedure Specification, NWGI. Measurements shall be made of the ‘A’ weighted

sound levels, dB(A), and also of the un-weighted octave band sound pressure levels, dB, at the nine centre frequencies of 31.5 Hz to 8 kHz.

In accordance with recommendations made in the OCMA specification the sound levels measured at the specified locations for neighborhood noise limits shall be compared with the BS 4142. 'Method of Rating industrial Noise Affecting Mixed Residential and Industrial Areas' to determine whether any adjustment is required.

The sound level after used for the tests shall be of the precision type and comply with the British Standards BS 5969 or the International Electro technical Commission Standard, IEC 651, Type 0. The octave band pass filter set shall comply with BS 2475 or IEC 225. The slow meter response setting shall be used.

Should the tests show that the noise levels exceed those specified the Contractor shall at his own expense make such changes of the plant and equipment or provide additional sound attenuation equipment as may be necessary to meet the specified levels, to the approval of the Engineer.

4.6.2 Hazardous Areas

The Contractor shall take full account of any special requirements concerning the nature, handling and storage of all fuel oils, gases and chemicals etc., and provide plant, equipment, buildings and other services accordingly including all facilities to ensure the safety of the operating and maintenance personnel.

The Contractor shall provide drawings to define all the hazardous zones taking account of all sources of hazards under normal and abnormal operating conditions, regardless of whether or not these areas are specifically listed in the specification. The zoning philosophy shall be in accordance with the National Electric Code and will be subject to the approval of the Employer.

In particular equipment directly concerned with plant which may give rise to a hazardous situation shall be designed to IEC 79 Zone 1 or 2 requirements with electrical connection safety barriers or intrinsically safe equipment equivalent to VDE 0171 Type Exit. Where required by the Engineer, certification shall be provided to confirm the suitability of the equipment and devices.

Electrical equipment shall not be installed in Zone 0 areas without the approval of the Engineer, though this does not preclude cables passing through such areas.

The Contractor shall be responsible for ensuring that all electrical equipment installed in any hazardous zone is designed and tested to suit the relevant zone classification and shall be to the approval of the Employer.

4.6.3 Access for Operation and Maintenance

The Contractor shall supply and erect all platform galleries, stairways, access ways and ladders necessary for providing safe and easy access to the plant items for operation and

maintenance. The Contractor shall ensure that the whole of the access ways are of uniform design and pattern throughout the Works.

4.6.4 Interlocks

A complete system of interlocks and safety devices shall be provided so that the following requirements and any other condition necessary for the safe and continuous operation of the plant are provided:

Safety of personnel engaged on operational and maintenance work on the plant.

Correct sequence of operation of the plant during starting up and shutting down periods.

Safety of the plant when operating under normal or emergency conditions.

Interlocks shall be preventive, as distinct from corrective in operation.

Where plant supplied under this Contract forms the whole or a part of a system for which one of more interlocking schemes are required, the Contractor shall be responsible for all interlocking schemes for the Employer's approval. General descriptions of interlocking requirements are given in the Specifications but the Contractor shall include for any other interlocks he considers necessary.

4.6.5 Guards

All moving parts; shafts, couplings, flywheels, bare conductors and hot or cold surfaces shall be adequately and securely guarded in accordance with the proscribed legislation and to the Employer's approval so as to afford complete safety to all personnel

4.6.6 Locks, Padlocks, and Key Cabinets

The Contractor shall provide padlocks, locks, chains or other locking devices for the locking of all equipment cubicles, electrical isolating switches, selector switches, valves, etc. to the approval of the Employer.

All locking devices and chains shall be manufactured from corrosion resistant material. All mechanisms shall be provided with a cover to minimize entry of water or dust.
Locks shall conform to a master keying feature system to be agreed with the Employer for groups of equipment.

All locks shall be individual high integrity and shall be provided with minimum 2(two) keys.
Each key shall be provided with a label as specified.

The Contractor will supply and fit key cabinets equipped with labeled hooks, each Identified with its appropriate key. Every cabinet shall be provided with a nameplate

identifying the cabinet with its respective item or items of plant. Sufficient cabinets will be provided to store all keys supplied under this Contract and cater for future extensions.

The Contractor shall provide comprehensive lock and key schedules to readily permit identification with equipment and doors. Such schedules are not required for loose padlocks.

Where modifications are performed to existing sites the Contractor shall provide a system identical to that existing.

4.7 VIBRATION AND BALANCE

The Plant shall be designed and constructed to operate without vibration insofar as the nature of the works will permit. Where vibration must be expected this shall be reduced to the minimum which can be achieved by good design, and careful balancing in the case of rotating plant.

The amplitude of vibration of rotating plant when measured on the bearing housings under steady state conditions at the designed operating speeds shall not exceed the values given by the 2.8 mm/s criterion of ISO 3945, that is:

Operating Synchronous Speed rev/min	Vibration Amplitude peak-to-peak mm
500	0.125
600	0.100
750	0.075
1000	0.050
1500	0.025
3000	0.025
6000	0.013
10000	0.008

Should the amplitude (peak-to-peak) exceed the above levels the Contractor shall reduce the amplitude to within agreed acceptable limits by methods approved by the Employer.

For large high-speed machinery (e.g. turbo-generators and boiler feed pumps) direct measurement on the shaft shall be provided. The vibration amplitude limits applicable at the shafts in these cases shall be agreed with the Employer, but these limits shall be such that the vibration levels on the bearing housing shall not be greater than given in section (a) of the foregoing.

In order to assist the achievement of the required level of vibration, for important items of rotating plant (e.g. turbo-alternator and feed pumps) the acceptable residual unbalance per unit of rotating mass shall be:

$$\frac{11000}{N} \quad \text{g.mm/kg}$$

Where N - shaft speed in rev/min.

This criterion is approximately equivalent to the G1 grade of ISO Recommendation 1940.

Provision shall be made for the reduction of vibration transmitted to covers, cladding, platforms and structures that are liable to vibrate. The vibration of any such radiating surface shall be such that the amplitude related to frequency does not exceed the following:

Frequency Hz	Amplitude peak-to-peak mm
0.40	
10	0.20
15	0.13
25	0.08
30	0.067
50	0.04
0.034	
100	0.20
0.017	

For intermediate values of frequency, the amplitude limit may be obtained from a graph having both values plotted on logarithmic scales.

4.8 OUTDOOR PLANT RATING, WEATHER PROTECTION AND SUNSHADES

Outdoor plant shall be rated and constructed so that its performance operation, reliability, maintenance, or life shall meet the specified design and operating conditions.

Where personnel have to be in attendance frequently or maintenance has to be regularly carried out. Permanent minimum weather protection or sunshades shall be provided.
Where the performance reliability or life of the plant would be adversely affected by solar radiation, including the effects of prolonged exposure to ultra violet light, suitable sunshades shall be provided.

Sunshades need not be provided on outdoor plant or equipment provided the manufacturer can show that no materials employed will be adversely affected or the temperature time due to internal heat generation plus that due to solar radiation does not exceed the equipment design temperature. However equipment requiring manual operation shall be provided with sun shades to ensure that surface temperatures are not in excess of 50^0C.

Sunshades shall protect plant and personnel when the sum is more than 45^0 degrees above the horizon. They shall not impede the operation or maintenance of the plant or the movement of ventilating air.

Facilities such as lighting and lifting beams and rainwater drainage shall be provided wherever necessary to the approval of the Engineer as an integral part of the sunshade structure.

4.9 PACKING AND MARKING

4.9.1 General

All plant and equipment shall be packed in accordance with the requirements of the supplier's recommendations, and the details in this Specification.

Nothing in these instructions shall relieve the Contractor of liability for any loss or damage arising out of deficient or inadequate packing.

Packing and any special freight instructions shall be clearly stated on orders and sub-orders.

If appropriate, arrangements should be made by the Contractor for special/valuable items to be supervised during transfer and storage at various points along the route and requirements in this respect should be advised at the same time as packing information.

All items containing internal packing/preserving/anti-corrosion materials shall be clearly marked to show this fact, to ensure that the packing/preservative materials are removed prior to installation/commissioning.

4.9.2 Cleaning & Protection Before Shipment

All bright metal parts shall be covered before shipment with an approved protective compound and protected adequately during shipment to Site. After erection these parts shall be cleaned with a correct solvent and polished bright where required. The Contractor shall supply the Engineer with correct information relating to the necessary removal of solvents required for the protective compounds applied in order to protect the Plant items during shipment and storage. These solvents shall be both non-toxic and non-flammable.

Before testing all steel pipes shall be thoroughly cleaned by an approved pickling process using a suitable inhibitor and shall then be thoroughly washed with hot water and lime washed before being finally washed internally with strong revolving wire brushes or shot blasting until all scale and sand have been removed. Any protective coatings that may be specified elsewhere in this Specification shall be applied after tests have been carried out.

After treating, all cast-iron pipes shall receive internally a coat of an approved quality rust prevention compound.

Pipes, valves and other similar parts of the Plant which are subject to hydraulic test and are not readily accessible for drying out shall on completion of tests at the manufacturer's works, be drained and washed with an approved dewatering oil prior to the application of the specified protection during transit and prior to site erection.

Valve pickings shall be removed after hydraulic test and replaced with dry packing.

All parts, which will ultimately be buried in concrete, shall be cleaned and protected before leaving the factory by a cement wash or other approved method. before being

handed over for building-in, they shall be thoroughly described and cleaned of all rust and adherent matter by wire brushing.

4.9.3 Packing Design

The packing requirements should be reviewed and confirmed at an agreed time prior to despatch (say 3 months).

Packaging should be in accordance with the relevant Sections of BS 1133 or equivalent National Standard and should be designed with regard to:-

Type of transport to be used

Intended (and possible alternative) route

Possible weather conditions along route

Labour and handling facilities available along route

Design of item to be packed, so that all necessary cradles, supports, checks, protective padding and lashings can be included in the packaging design.

Protection against fresh or salt water and/or water vapor.

Where specified elsewhere in this specification impact indicating devices and recorders shall be provided to establish if and when excessive levels of impact have occurred whilst in transit.

4.9.4 Transport of Complete Plant Items or Modules

Special care should be taken in the instructions and requirements for transported modules. In particular, the following points should be considered:-

Design and arrangement of holding down bolts or other fastenings (including welded shear blocks if applicable).

Prevention of undue movement of flexibly mounted items, but consideration to be given avoiding shock loadings.

Effects of position of the Centre of Gravity

Effects of flexing of the module during lifting and the need for disconnecting drive shafts, pipe works, linkages, couplings etc. (After match-marking as appropriate).

Securing internal loose or moveable parts e.g. un-damped flap valves.

Traveling cranes to be moved to end stops, wheels wedged and gantry and crab lashed.

Should the Contractor be proposing to transport such items, details of the proposed means of packing shall be forwarded to the Employer.

4.9.5 Long-Term Storage

Should items of plant require long-term storage on site, or elsewhere. Measures should be taken of the followings as appropriate, in agreement with the Employer:

Environmental protection to be provided:

Active-Space heating/anti-condensation heaters
Passive-Coatings/desiccants (silica gel)/filling with inert gas or liquid

Protection of items of plant by:-

Blanking nozzles by metal or wood closures with gasket
Greasing or oiling bearings. (Special preservative oil etc.)
Rotating shafts periodically
Application of rust preventative on machined surfaces

(c) In the case of rotating equipment the following should be taken care of:-
- (1) Run/turn periodically or system drained and inhibited
- (2) Oil in oil systems circulated periodically by hand pump
- (3) Anti-condensation heaters turned on
- (4) Protective coatings
- (6) Desiccants or filled with inert gas
- (7) Scale removed and coated with preservative oil
- (8) Moving parts, e.g. valves, left in a position which will afford the best protection.
- (9) Complete sealing of bearings housings, inlets outlets and vents

(d) Inspection during storage:-
- (1) All items shall be available for inspection by the Employer. For items stored at site access shall be granted on request.
- (2) Items stored elsewhere than Bangladesh a minimum of 72 hours notice of inspection shall be given.
- (3) The Contractor shall be responsible for performing regular inspections to ensure no deterioration occurs as a consequence of long-term storage.

4.9.6 Marking of Packages

All packages shall be marked on two opposite sides and on the top, using fade proof, waterproof and salt proof green ink as required.

Characters shall be at least 50 mm high unless package is too small, in which case the size shall be in proportion.

If marking tags have to be used on bundled structural material, the tags shall be made of metal and clamped flat to each bundle. Paper or cloth tags are not acceptable.

Packages shall be marked on all four sides with arrows pointing to the top.

Fragile or perishable materials shall be marked with the appropriate symbol, i.e. FRACILE, HANDLE WITH CARE< COOL STORAGE, REEFER STORAGE, USE NO HOOKS.

When required due to length or unbalanced weight, containers or pieces shall have centre of balance indicated by painted stripe extending upward on each side with wording "CENTRE OF BALANCE".

Sling marks shall be shown as required

Fabricated sections of structures and equipment shall have their respective piece marks permanently stamped into the piece to a minimum depth of 1.0 mm and the stamped areas painted with corrosion protective paint of a different colour to the base colour. Characters shall be at least 10 mm high.

On vehicles, unboxed earth moving equipment or materials handling equipment, etc., the markings may be shown on a notice suitably fastened to the windshield etc. These shipping marks are separate from and not to be confused with vehicle or equipment colour requirements and equipment identification numbers.

4.9.7 Documentation

A copy of the packing list shall be placed inside each shipping package. A copy of the packing list in a waterproof envelope shall be securely fastened to unpackaged places or bundles.

Packing lists shall indicate the name of the Client/Contractor and the Contract number.

Separate packing lists shall be prepared for each and every shipment made. In the case of several packages included in a single shipment, more than one package may be included on one packing list, providing all required information is shown for each package.

The following information shall be provided for each package:

Description of package, i.e. box, crate, drum, bundle etc.
Package number
General description of contents corresponding to the invoice.
Equipment number where applicable
Gross, tare and net weights in kilograms
Dimensions of package

4.9.8 Erection Marks

All members comprising multipart assemblies, e.g. steel framework, piping installations, etc. shall be marked with distinguishing numbers and, or letters corresponding to those of the approved drawings or material lists. These erection marks, if impressed before painting or galvanizing, shall be clearly readable afterwards.

Colour banding to an-approved code shall be employed to identify members of similar shape or type but of differing strengths or grades.

4.10 LIFTING TACKLE, TOOLS AND MAINTENANCE EQUIPMENT

4.10.1 Employer's Property

The following tools and appliance shall be supplied under this Contract. The Contractor's full list with itemized prices and details shall be given in Schedule of Test Equipment, Tools and Maintenance Equipment.

One set of standard tools, spanners, etc. of appropriate size and type to fit each nut and bolt on the whole of the plant and equipment covered by the Contract.

One set of any special tools and gauges plus sets of test plugs, leads, connectors, etc at each sub-station required for the normal maintenance of the whole of the plant and equipment installed at that site under the Contract.

One set of any special lifting and handling appliances required for the normal maintenance of the whole of the plant and equipment covered by the Contract.

Two sets of any special tools, gauges or other special test equipment required for the dismantling, reassemble, checking or adjustment of the whole of the plant and equipment covered by the Contract.

Each tool and appliance shall be clearly marked with its size and/or purpose and shall not be used for erection purposes.

Each set of tools and appliances under the above items shall be suitably arranged in separate fitted boxes of mild steel construction, or locally produced padlockable cabinets installed in the sub-station. The number of boxes being determined in relation to the layout of the plant and equipment in question. If the weight of any box and its contents should be such that it cannot be easily carried, it shall be supported on storable rubber-tyred wheels.

Each box shall be fitted with a lock and shall be painted black and clearly marked in white letters with the name of the plant or equipment for which the tools and appliances therein are intended.

Suitable storage racks shall be provided for all portable lifting tackle in this contract.

Suitable lifting lugs, ears or ring bolts, or tapped holes for lifting rings shall be provided on all equipment items where the weight exceeds 15 kg.

All lifting tackle shall be stamped with a unique identification number and safe working load. A test certificate from an approved Authority shall be supplied for each item of lifting tackle.

The Contractor shall provide a schedule of all lifting tackle and tools and appliances being supplied, for the approval of the Employer.

The Contractor shall provide all runway beams, trolleys lifting blocks, special slings etc. necessary for the safe and efficient handling and maintenance of the works.

Unless otherwise stated the following minimum standards shall apply to lifting tackle:-

Wire rope slings	-	BS 1290, BS 3481, BS 5281
Lifting Chains	-	BS 2902, BS 3458
Runway Beams	-	BS 2853

The tools and appliances with the appropriate storage racks, cabinets and boxes shall be handed over to the Employer at the time of taking over the associated section of the Works.

4.10.2 Contractor's Property

The Contractor's shall provide all tools, appliances and other equipment required for the complete erection, testing and commissioning of the works. Such tools, appliances and equipment shall, upon completion of the Contract, remain the property of the Contractor and shall be removed from the Site.

4.11 SPARE PARTS

The Contractor is responsible for providing adequate stocks of spare parts. In selecting plant for duty in Bangladesh serious consideration is to be given to the spares requirements. Manufactures are to certify that they shall ensure spare parts will be available for the lifetime of the equipment.

All parts supplied must be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the plant. They shall comply with the Specification and are to be suitably marked and prepared for storage and provided in containers or packaging suitable for storage on tropical conditions. Where an item is subject to a limited shelf life this shall be clearly indicated on the spares list, and the packaging etc shall be marked with the expiry date.

4.11.1 Maintenance and Essential Spares

The Contract is to include for all spares required for the normal overhaul maintenance and repair of the plant supplied for a period of 5 years from the completion of the Contracts.

Due to the remote location of Bangladesh, and the inherent difficulties of obtaining convertible currency in order to purchase spare parts, the Contractor is required to carefully evaluate the spare parts requirements.
The Contractor must be able to justify his proposed schedule of spares, taking the above into account. If during the execution of the contract the Employer considers that the proposals for spares is inadequate, (as supported by manufacturers spare parts recommendations) the Contractor shall be required to remedy the shortfall at his own expense.

In addition to the spare parts for the major items of plant, such as switchgear and transformers, which are to be delivered to the Employer's stores the Contractor shall install lockable storage racks and cabinets at each sub-station. These racks and cabinets are to be locally manufactured and are to contain the spares required for the remainder of the plant at that site. Inventories of the spares provided are to be included, and these items are to be handed over, with the Taking-over of the individual sections of the works.

4.11.2 Emergency Spares

Emergency Spares provided for Maintenance and Essential purposes, the Contractor is to propose a schedule of Emergency spares he considers that it would be prudent for the Employer to purchase for next 5 (five) years. These spare are to contain parts that would not normally be provided, but due to their long lead-time, or essential nature in the case of accidents or emergencies, would be required to return the plant to service.

The Employer may order all or any of these spares at his discretion.

4.11.3 Commissioning Spares

In addition to the spare parts being provided for the Employer, the Contractor is responsible for ensuring that he has access to a stock of commissioning spares. Spares provided for the Employer are not to be utilized as commissioning spares, without written approval, in which case the Contractor shall immediately replace the contract spare at his own expense.

All commissioning spares are considered as Contractors Equipment.

4.12 CONSUMABLE ITEMS

4.12.1 Lubricants

All lubricants proposed for the Works shall be suitable for all operating and environmental conditions that will be met on site.
All oils and greases shall where possible be readily available in the country of installation.

The number of oils and greases shall be kept to a minimum and the Contractor shall submit to the Engineer for approval a Schedule containing all items of the works which require lubrication together with the quantity type and grade of lubricants required.

The Contractor shall supply the first fill of lubricants for all Plant supplied under the Contract and any addition up to the final date arising from the Reliability Trial and previous operation:

The Contractor shall provide to the Employer at the issue of the Taking Over Certificate for each Section of the Works sufficient flushing oils, lubricants and greases necessary for efficiency operating and maintaining the plant at full load 24 hours per day for a period of 12 months.

4.12.2 Chemicals and Other Consumables

The Contract includes for the provision of all chemicals, resins, and other consumables required for testing, commissioning and setting to work of each section of the Works.

Unless otherwise stated, the Contractor shall provide all such chemicals and other consumables required for the efficient operation and maintenance of the plant at full load 24 hours per day for a period of 12 months for each section of the works from the date of the Final certificate.

The Contractor shall prepare a list of these consumables giving quantities necessary for each section of the works and the recommended suppliers.

4.13 PAINTING AND CLEANING

Immediately following the award of a Contract, the Contractor shall submit the names of the proposed paint supplier and applicator together with a quality assurance programme for approval. All paints for a contract shall be provided by one manufacturer and preferably shall be manufactured in one country to ensure compatibility

The painting of the plant shall be carried out in accordance with the appropriate schedule. The work is generally covered by the schedules but where particular items are not referred to specifically, they shall be treated in a manner similar to other comparable items as agreed with the Employer.

The schedule indicate standards of surface preparation and painting which is intended to give a minimum service life of 10 years in a coastal industrial environment, with need for minor remedial work only during the intervening period.

Steel sections and plate shall be free from surface flaws and laminations prior to blast cleaning and shall not be in worse condition than Pictorial Standard B, Swedish Standard SIS 05 5900.

The Employer is prepared to consider alternative paint schemes to meet the requirements of fabrication using modern automated materials handling systems, provided they offer the same standards of surface protection and service life as those intended by the schedules.

All paints shall be applied by brush or spray in accordance with the schedule, except for priming coats for steel floors, galleries and stairways where dipping is permitted.

Where paint is to be applied by spray, the applicator shall demonstrate that the spray technique employed dies not produce paint films containing vacuoles.

Where paint coatings are proposed for the protection of surfaces of equipment exposed to corrosive conditions, such as plant items exposed to brines or sea water immersion in liquid, or wet gases, the coatings shall be formulated to the suitably corrosion resistant and shall be high voltage spark tested at works and/or at Site prior to commissioning. The test procedure shall be based on the use of a high voltage direct current. The voltage used shall be 75% of the breakdown voltage of the coating. This breakdown voltage shall first be separately determined using test plates coated with the specified coating formulation and thickness. The coating on the test plate shall also be micro-sectioned by the applicator to show that it is free from vacuoles and other defects likely to invalidate the test procedure.

If the defects revealed by the above test procedure do not exceed one per 5 m^2 of coating surface, the coating need not be re-tested after the defects have been repaired. If the defects exceed one per 5 m^2 of coating surface, the repairs shall be resettled after any curing is completes, and this procedure shall be repeated until the defects are less than one per 5 m^2 of coating surface. After repair of these defects, the equipment can be placed in service without further testing.
All coating proposed for the internal protection of domestic water storage tanks and desalination plants shall be certified by an approved independent Authority as suitable for use in potable water installations and shall meet the non-painting requirements of BS 3416.
All plain shed and bright parts shall be coated with grease, oil or other approved rust preventive before despatch and during erection and this coating shall be cleaned off and the parts polished before being handed over.

Where lapped or butted joints form part of an assembly which is assembled or part assembled prior to final painting, the jointed surfaces shall be cleaned free from all scales, loose rust, dirt and grease and given one brush applied coat of zinc phosphate primer before assembly.

Paint shall not be applied to surfaces which are superficially or structurally damp and condensation must be absent before the application of each coat.

Painting shall not be carried out under adverse weather conditions, such as low temperature (below 4^0C) or above 90% relative humidity or during rain or fog, or when the surfaces are less than 3^0C above dew point, except to the approval of the Employer or his duly appointed representative.

Priming coats of paint should not be applied until the surfaces have been inspected and preparatory work has been approved by the Employer or his duly appointed representative.

No consecutive coats of paint, except in the case of white, should be of the same shade. Thinners shall not be used except with the written agreement of the Employer.

On sheltered or unventilated horizontal surfaces on which dew may linger more protection is needed and to achieve this an additional top coat of paint shall be applied.

The schedules differentiate between 'Treatment at Maker's Works' and 'Treatment at Site after Completion of Erection' but the locations at which different stages of the treatments are carried out may be modified always providing that each change is specifically agreed to by the Employer and the painting is finished at Site to the Employer's satisfaction.

All paint film thickness quoted are minimum and refer to the dry film condition. all thickness shall be determined by the correct use of approved commercial paint film thickness measuring meters.

The Contractor shall ensure that precautions are taken in packing and crating to avoid damage to the protective treatment applied before shipment, during transport to the site.

Structural bolts shall be galvanized or cadmium plated and painted as for adjacent steelwork.

All structural timber that does not require to be painted (timber joists, flooring, etc) shall be treated with two coats exterior grade approved timber preservative.

The requirements of this clause and the schedules shall be interpreted in accordance with the requirements and recommendations of BS 5493 and CP 231, 3012 and the paint manufacturer's special instructions where applicable.

Colour shall be in accordance with BS 1710 and BS 4800 or equivalent material standards.

4.14 GALVANIZED WORK

All galvanizing shall be carried out by the hot dip process (and unless otherwise specified, shall conform in all respects with IEC's).

Attention shall be paid to the detail of members, (in accordance with IEC's). Adequate provision for filling, venting and draining shall be made for assemblies fabricated from hollow sections. Vent holes shall be suitably plugged after galvanizing.

All surface defects in the steel, including cracks, surface laminations, laps and folds shall be removed (in accordance with IEC's). All drilling, cutting, welding, forming and final fabrications of unit members and assemblies shall be completed before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from welding slag, paint, oil, grease and similar contaminants.

The coating shall be as specified in BS 720 or equivalent National Standard. Structural steel items shall initially grit blasted to BS 4232, second quality (SA2.5) and the minimum average coating weight on steel sections 5 mm thick and over shall be as specified in the Table below:

THICKNESS OF STEEL SECTION mm	THICKNESS OF ZINC COATING microns	MINIMUM AVERAGE COATING WEIGHT g/m^2
5	80 - 90	600
10	100 -120	750
20	120 - 150	900

With intermediate values on a pro rata basis.

On removal from the galvanizing bath the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Galvanized contact surfaces to be jointed by high strength friction grip bolts shall be roughened before assembly so that the required slip factor (defined in BS 3294. Part I and BS 4606 Part 1) is achieved, Care shall be taken to ensure that the roughening is confined to the area of the faying surface.

Bolts, nuts and washers, including general grade high strength friction grip bolts (referred to in BS 3139 and BS 4395 Part 1) shall be hot dip galvanized and subsequently centrifuged (according to BS 729). Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads oiled to permit the nuts to be finger turned on the bolt for the full depth of the nut. No lubricant, applied to the projecting threads of a galvanized high strength friction grip bolt after the bolt has been inserted through the steelwork shall be allowed to come into contact with the faying surfaces.

During off-loading and erection, nylon slings shall be used. Galvanized work which is to be stored in works on Site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanized coating damaged in any way shall be brought to the attention of the Employer who shall authorize repair by:

Cleaning the area of any weld slug and thorough wire brushing to give a clean surface.

The application of two coats of zinc rich paint or the application of a low melting point zinc alloy repair rod or powder to the damaged area, which is heated to 300^0C.

After fixing, bolt heads, washes and nuts shall receive two coats of zinc rich paint.

4.15 CHROMIUM PLATING

The chromium plating of those components of the plant where specified and where offered by the Contractor should comply with the requirements of BS 1224 or equivalent National Standard.

4.16 MECHANICAL ITEMS

All screw threads shall be of the ISO metric form and the diameters and pitch of thread for all bolts studs and nuts shall conform to the ISO Standards as stated in BS 3692 or BS 4190 or equivalent National Standard.

It is recognized that in a number of applications such as instrument, machine components and pipe, other thread forms may be used.

4.16.1 Pipe work

All piping shall be designed, manufactured and tested in accordance with British Standards or equivalent Nationals Standards approved by the Employer. In particular, pipe work should meet the requirements of the following standards or their equivalents. Dimensions shall comply with Table 1 of BS 1600. The minimum wall thickness of carbon steel pipes excluding any allowance for corrosion shall be as shown in British Standards:

DIAMETER	MINIMUM WAL THICKNESS
0 - 100 mm	Table 2 BS 1387:1967
150 - 200 mm	4.87 mm
250 - 600 mm	6.35mm

Drains and air vents shall be provided as required by the physical arrangement of the pipe work and shall be via valves with the drain and vent pipe work led to drain points to the approval of the Employer.

Screwed pipe work systems shall be provided with adequate unions to enable valves and fittings to be removed if required with minimum disturbance to the rest of the pipe system.

4.16.2 Valves General

All valves shall be suitable for the service conditions under which they are required to operate and those of similar size and performing similar duties shall be interchangeable with one another unless otherwise approved.

All valve connections shall be suitably protected to prevent damage in transit and the entry of dirt. Plugs driven into the end of valve connections will not be accepted.

All isolating, non-return, control, float, relief and air release valves necessary to ensure full control of all the services provided, are to be included.

All valves shall be positioned so as to be readily accessible for operation and maintenance.

All valves up to an including 75 mm bore shall be made of gunmetal. Subject to the approval of the Engineer, larger valves may have cast iron bodies with gunmetal fittings.

All valves 50 mm bore and above shall be flanged or welded unless otherwise approved.

All valves shall be closed by rotating the hand wheels in a clockwise direction when loading at the face of the hand wheel.

Every valve shall be provided with an indicator to show clearly the position of the valve and each hand wheel shall be fitted with a nameplate with engraved and filled letters of figures to provide an approved inscription which will indicate the purpose of the valve.

In order to prevent mal-functioning and deterioration due to the prevailing climatic conditions, the spindles shall be protected in robust weatherproof covers where valves are located outside. The glands shall be easily accessible and designed to exert an even pressure on the valve stem without binding. Precautions are to be taken to prevent corrosion of the valve spindle where in contact with the valve packing. All valves shall have renewable seats where practicable. It must be possible to remove and replace or recondition in situ, the seats and gates of valves 50 mm nominal bore and above and any special tools for these purposes are to be included in the Contract. For valves less than 50 mm bore the valve will be removed for maintenance purposes.

4.16.3 Valve Locks

Where, for operational or safety requirements, a valve should be permanently locked in either the 'Open' or 'Shut' position, i.e. and oil tank drain, a locking device shall be provided and shall include a padlock chained to the valve and two keys.

4.16.4 Structural Steelwork

All structural steelwork shall be detailed, fabricated and erected in accordance with the requirements.

4.16.5 Bolts, Studs, Nuts and Washers

All bolts, and nuts shall conform dimensionally to the requirements of BS 3092 or BS 4190 or equivalent National Standard.

The Material of all bolts, studs and nuts for piping systems shall conform to the requirements of BS 4505 or equivalent National Standard.

The threaded portion of any bolt or stud shall not protrude more than 1.5 threads above the surface of its mating nut.

When fitted bolts are used they shall be adequately marked to ensure correct assembly. Bolts, nuts, studs and washers in contact with sea water or used on pipe work systems containing sea water shall be of the same material as flanges etc.

The use of slotted screws shall be avoided, hexagon socket screws or recessed type heads being preferred.

4.16.6 Castings

All castings are to be free from blowholes, flaws and cracks. No welding, filling, interlocking or plugging of defective parts is to be done without the prior knowledge of

the Employer, nor without his approval in writing. Full details of the proposed method of repair shall be submitted for approval.

Castings which have been repaired are to be subjected examination by approved non-destructive methods including ultrasonic and radiography after heat treatment.

Cast iron is not to be used for any part of the equipment which is in tension or which is subjected to impact. Valve bodies shall not be made of cast iron.

4.16.7 Welding

All welding shall be carried out in accordance with the relevant British or other equivalent National Standard Specification as applicable. Where there is no such applicable standard, the welding technique and procedure shall be carried out to standards determined by agreement between the Engineer and the Contractor.
Welded on attachments such as lugs, supports, etc., shall not encroach on any pressure welds, except in special instances where this may be acceptable with prior approval of the Engineer. Attachment welds shall have a contractor which is free from notch effects at the weld junction. Such welds shall be made only by welders qualified for butt welding under the requirements of the appropriate British Standard Specification.
Welding of galvanized structures shall be carried out before galvanizing.
All tube butt welds shall have 100% penetration with a maximum of 3 mm excess penetration in the root run, to the satisfaction of the Employer.

When weld repairs are necessary the Employer shall be informed and given the option of making an examination after the defect has been removed and before welding commences. Repairs shall be in accordance with the relevant British or National Standard Specification.

4.16.8 Couplings and alignment

Where an auxiliary is mounted with its driver on a common bed plate, approved packers of a total minimum thickness of 6 mm shall be provided between the driver feet and the bed plate to allow for accurate alignment of the unit on the bed plate.

All couplings shall be fully checked for alignment and all necessary equipment for checking coupling alignment shall be supplied by the Contractor and shall remain the property of the Government after 'Taking Over'.

4.16.9 Electrical Equipment Enclosures

Equipment enclosures for electrical equipment shall comply with IEC 34-5, IEC-79, IEC-144, IEC 298, IEC 529 and BS 5227 as applicable. Unless otherwise specified equipment enclosure classes shall be as follows:-

(a)	Rotating Electrical Machines -	Indoors:	IP 44
		Outdoors	IPW 55

(b)	Electrical Equipment (other than Rotating Machines)	-	Indoor only in totally enclosed rooms with provision for limiting ingress of dust:	IP 43
			Indoors, except as noted below:	IP 52
			Outdoors, and indoors in areas subject to water spray, or heavy condensation:	IPW 54
(c)	HV Electrical Switchgear Indoors:			IPH 6

Dust enclosures with first characteristic numeral 5 shall comply with the requirements of the tests for enclosures with first characteristic numeral 4, unless otherwise agreed.

4.17 CURRENT RATINGS

4.17.1 Normal Current Ratings

Current ratings in accordance with IEC 59 shall be adopted, unless otherwise agreed with the Employer.

Every current carrying part of the equipment shall be capable of carrying its site rated current continuously under the Site conditions as specified, and in no case shall the permitted temperature rise be exceeded.

The current ratings specified are the continuous current ratings required at the Site, under the specified maximum temperature and solar gain conditions.

4.17.2 Temperature Rise

Full provision shall be made for solar heat gain on all apparatus and any differential temperatures attained as a result of the impingement of solar heat.

The allowable temperature rise shall be in accordance with the relevant Standard, save where the ambient temperature exceeds the maximum permitted in that Standard, when the permitted temperature rise shall be reduced by one degree Celsius for every degree Celsius the maximum ambient temperature exceeds the maximum permitted in the Standard.

In such cases where the Contractor is unable to guarantee the permitted total temperature reached under site conditions taking account of solar heating, then sunshades shall be provided to the Employer’s approval.

The maximum temperature attained by components under the most onerous service conditions shall not cause damage or deterioration to the equipment or to any associated or adjacent components.

4.17.3 Short-Time Current Ratings

Electrical equipment shall be adequately supported and braced to withstand the forces associated with the maximum short-circuit currents specified or pertaining, whichever is the greater, and assuming that the inception of he short-circuit is at such a time that gives maximum peak currents. No provision for current decrement shall be made unless specifically permitted by the appropriate Standard, or elsewhere in this specification.

Equipment shall be so constructed as to withstand the specified maximum short-circuit currents for a duration of 3 seconds without the temperature exceeding the specified maximum short-time temperature or value stated in the relevant standard, under these conditions. The equipment shall be considered as being operated at the maximum permitted continuous temperature prior to inception of the short-circuit.

The final temperature attained as a result of the passage of short-circuit current shall not cause permanent damage, or deterioration sufficient to reduce the normal operating characteristics below the specified or most onerous operating requirements whichever is the highest.

4.18 VOLTAGE RATINGS

4.18.1 Normal Voltage Ratings

Unless otherwise specifically stated, any reference to voltage rating shall be deemed to refer to the Nominal rated voltage or voltages of electrical equipment. Standard voltage levels in accordance with IEC 38 shall be adopted, unless otherwise specified or agreed with the Engineer. Transformer rated voltages shall comply with IEC 76.

All electrical equipment shall, except where otherwise specified, be capable of continuous operation at a voltage level in the range of 90 per cent to 110 per cent of the nominal voltage without deterioration.

Alternating current rotating electrical machines shall be capable of providing rated output within the voltage range 95 per cent to 105 per cent of normal rated voltage.

The temperature rise of electrical equipment continuously operating at the specified minimum or maximum voltage shall not exceed the temperature rise when operating at nominal voltage by more than 5 degrees Celsius.

All D.C. equipment shall be capable of satisfactory continuous operation in the conditions specified when subjected to the maximum boost voltage output of the associated battery chargers unless dual battery & charger systems adequately controlled

and interlocked are provided in which case they shall be capable of continuous operation at the maximum possible float charge voltage.

In addition all D.C equipment shall perform satisfactorily at D.C. voltage down to 85% of the specified nominal voltage. Tripping relays and coils etc shall operate down to 80% of the specified nominal voltage.

4.18.2 Short-Time Voltage Ratings

All electrical equipment shall be so designed such as to withstand abnormal system voltages as required by the appropriate Standard.

4.19 L.V. CIRCUIT PROTECTION

Fuses are not to be used for protection of circuits below 1000v phase-to-phase, (Low Voltage).

All low voltage and dc circuit protection is to be provided by moulded case, or miniature circuit breakers.

Link carriers and bases shall be of an approved manufacture and of such form and material so as to protect persons from shock and burns in normal service and maintenance. Links, and fixed contacts shall be shielded to prevent inadvertent contact with live metal whilst the link is being inserted or withdrawn.

The labeling of carriers and bases shall comply with IEC 269 Identification labels fixed to panels, boards and desks for MCCB's and links shall describe their duty, voltage and rating.

4.19.1 Miniature Circuit Breakers

All miniature circuit breakers (MCCB's) shall comply with IEC 157 and be fitted with over-current releases of both the thermal and instantaneous type. all MCCB's supplied on this contract shall be to short circuit category P2 of IEC 157.
Single, two or three pole breakers may be used where appropriate and a trip of one pole shall cause a complete trip of all associated poles. In addition the rating given of MCCB's supplied shall be confirmed as that appropriate to the enclosure provided.
The Contractor shall ensure satisfactory time and current grading with other associated miniature circuit breakers or MCCB's.

4.19.2 Distribution Boards and Isolators

Distribution boards shall be provided throughout the plant for local distribution of lighting, small power and air conditioning supplies. The lighting and small power circuits may use a common distribution board.

Distribution boards shall be of 1 kV a.c., 1.2 kV d.c. rating and conform to IEC 439. All distribution boards shall be of the weatherproof enclosure type and shall be arranged so that the door or cover can be locked in the closed position.

All triple pole and neutral boards shall provide satisfactory cable entry for all cables which could be required for the number of circuit facilities provided and shall have the neutral bar drilled for the full number single phase ways.

Each distribution board supplied from a remote location shall have a load breaking/fault making incoming isolating switch mounted adjacent to or as part of the distribution board. Each distribution board shall have removable top and bottom (un-drilled) gland plates.
Each circuit in every distribution board shall be numbered and identified by means of a schedule attached to the interior of the door or cover of the board. The schedule shall be legible and durable to the Employer'' approval.

Twenty-five percent spare ways shall be provided for future use.

4.20 CURRENT TRANSFORMERS (CTs).

The current transformer rated current ratio shall match the connected load circuit and secondary circuit requirements.
Current transformers shall be capable of withstanding without damage the full load, peak and rated short time currents of their associated equipment.
Current transformers used for energizing indicating instruments shall be of Class 0.2 accuracy and for energizing integrating meters Class 0.2 accuracy.
Current transformers for protective and protective/indication purposes shall be designed to suit the particular requirements of the associated protection which in general shall be in accordance with the recommendations given in BS 3938 or approved equivalent.
Class 5p current transformers shall be used for inverse time over-current and/or earth fault protection. The rated accuracy limit current shall be equivalent to the maximum symmetrical three phase fault current or earth fault current of the protected circuit or equivalent to he switchgear breaking capacity unless otherwise approved by the Employer. The current transformers shall be capable of meeting the 5p error classification at rated accuracy limit current over the full range of relay settings, unless otherwise approved by the Employer.

Current transformers used for indication/metering purposes shall be designed to saturate at a value of primary current sufficiently low to protect the secondary circuit from damage at all possible values of primary fault current up to the associated primary short time thermal rating.

The rated volt-amp output of each current transformer shall not be less than 110% of the connected burden as installed in service, the burden of cable connections being taken into account.

The secondary windings of each set of current transformers shall be earthed at one point only via an accessible bolted disconnecting link, preferably located within the relay cubicle.

Where double-ratio secondary windings are specified provided a label shall be provided at the secondary terminals of the current transformer indicating clearly the connections required for either tap. The connections and the ratio in use shall be indicated on all connection diagrams.

Design magnetization curves and d.c resistance values shall be submitted before manufacture for each current transformer used for protective purposes and shall be subsequently verified by works routine tests and also by site commissioning tests.

Where current transformers have to operate or be mounted on apparatus provided under other contracts, the Contractor shall be responsible for ensuring design and installation compatibility with other Contractors and for keeping the Employer informed.

4.21 VOLTAGE TRANSFORMERS (VTs)

Voltage transformers shall comply with the requirements of IEC 186 with amendments and supplements and shall be of:-

VT secondary windings shall be of class 3p accuracy for indicating metering and class 0.2 accuracy for tariff metering or acceptance efficiency testing.

The VA output shall be 50% in excess of the design requirements except for tariff metering voltage transformers which shall be at least 10% in excess of the design requirements.

For tariff metering voltage transformers the Contractor shall check the total installed secondary burden and if necessary shall install dummy burdens to achieve the calibrated accuracy.

Voltage transformer secondary circuit shall be earthed at one point only and metal cases shall be separately earthed. The transformers core, where accessible, shall also be separately earthed.
All voltage transformers in the system at a given voltage level shall be earthed in the same manner.
Where three single phase voltage transformers are supplied for protection purposes, star connected secondary windings shall have the star point formed by insulated connections and shall be earthed at a common point.
Where possible primary windings shall be connected through fuses with current limiting features.

Secondary MCCB’s shall be provided as close as possible to each voltage transformer and labeled to show their function and phase colour. The secondary circuits shall be

monitored individually to detect and alarm individual fuse failure or MCB trip and to block protection operation if required.

Voltage transformers shall be an designed that saturation of their cores does not occur when 1.732 times normal voltage is applied to each winding.

Magnetization curves shall be submitted for approval for each type of voltage transformer.

The standard secondary voltage between phases shall be 110 volts unless special circumstances dictate otherwise, and are approved by the Employer.

Secondary circuits from different voltage transformers, or separate windings of the same transformer, shall not be connected in parallel.

Voltage transformers shall be installed at end structure of the switch yard and connected on the busbar-end side

4.22 ELECTRICAL EQUIPMENT, INSTRUMENTS AND METERS

All instruments and meters shall be fitted with glasses of low reflectivity and shall not cause pointer deflection due to electro-static charging through friction.

All indicating instruments shall be of the flush mounted pattern with dust and moisture proof cases complying with BS. 2011, Classification 00/50/04, and shall comply with BS. 89:1977 or IEC. 51.

Unless otherwise specified, all indicating instruments shall have 95mm square cases to DIN standard or equivalent circular cases.

Instrument dials in general should be white with black markings and should preferably be reversible where double scale instruments are specified.

Scales shall be of such material no peeling or discoloration will take place with age under humid tropical conditions.

The movements of all instruments shall be of the dead beat type.

Instruments shall be provided with a readily accessible zero adjustments.

The mounting height of the centre of all indicating instruments shall not exceed 2000mm.

AC. ammeters for feeder or bus coupler, and DC ammeter for all load circuits except motors, shall have linear scales commencing at zero.

AC and DC ammeters for motor circuits shall have scales commencing at zero and with a compressed overload portion for reading of the associated minor starting current.

DC. ammeters for the main battery circuit of DC systems shall have scales with positive and negative ranges, labeled charge and discharge respectively.

Voltmeters for feeders and transformer circuits shall have expanded scales to display the nominal service voltage ± 20%.

Wattmeter’s for feeders shall have linear positive reading scales to be approved.

Varmeters for all circuits shall have linear positive and negative reading scales to be approved.
Integrating metering shall be provided where indicated on the specification drawings. These meters shall be of the with drawable flush mounted type and comply with the relevant parts of IEC 521 and BS 5685, Class 0.2 accuracy and BS 37, Part 9. The meters shall include cyclometer dial type registers.

Approved test terminal blocks of the three-phase type shall be provided for connecting in circuit with each meter a portable testing meter.

Recording instruments shall be of an approved type, and unless otherwise specified, shall have tow chart speeds of 25 mm and 50 mm per hour available for selection by means other than changing connections. They shall be complete with sufficient charts and inks for two years' working.

All instruments, meters, recorders and apparatus shall be capable of carrying their full load currents without undue heating. They shall not be damaged by the passage of fault currents within the rating of the associated switchgear through the primates of their corresponding instrument transformers.

All instruments, motors and apparatus shall be back connected and the metal cases shall be earthed.

All voltage circuits to instruments shall be protected by a MCB in each unearthed phase of the circuit placed as close as practicable to the main connection.

All power-factor indicators in 3-phase circuits shall have the star point of their current coils brought out to a separate terminal which shall be connected to the star point of the instrument current transformer secondary windings.

All instruments and meters associated with multi-ratio CT's shall be provided with sets of scales etc. appropriate to each CT ratio. It shall be possible to replace the scales of instruments without dismantling the instruments or interfering with any tropicalization finish.

The Contractor shall provide electrical instrument and meter schedules to include, manufacturer, type designation, current and voltage rating, accuracy class and circuit designation.

4.23 CONTROL AND SELECTOR SWITCHES

Control switches shall be of the three position type with a spring return action to a central position (and without a locking feature).

Circuit breakers shall have control switches which shall be labeled open/N/close or (O/N/C) and arranged to operate clockwise when closing the circuit breakers and anti-clockwise when opening them, and shall be of the pistol grip type.
Control switches of the discrepancy type shall be provided where specified, i.e. mimic panel. Such discrepancy control switches shall be arranged in the lines of the mimic diagram. Such switches shall include lamps and be of the manually operated pattern, spring loaded such that it is necessary to push and twist the switch past its indicating position for operation. The lamp shall be incorporated in the switch base and shall flash whenever the position of the circuit breaker is at variance with the position indicated by the control switch. Hand dressing of the control switch to the correct position shall cause the lamp to extinguish.

Selector switches shall be of the two or more position type as required, and have a stay-put action to remain in any selected position which shall be lockable (separate padlocks each with duplicate keys should be provided). Each position of the selector switches shall be suitably labeled to signify their function. The switch handle shall be of the pistol grip type to the approval of the Employer.

It shall not be possible at any time operate any switchgear equipments from more than one location simultaneously, and suitable lockable selector switches shall be provided to meet this requirement.

The contracts of all control and selector switches shall be shrouded to minimize the ingress of dust and accidental contract, and shall be amply rated for voltage and current for the circuits in which they are used.

4.24 AUXILIARY SWITCHES

Auxiliary switches shall be to approval and contracts shall have a positive wiping action when closing.

All auxiliary switches, whether in service or not in the first instance, shall be wired up to a terminal board and shall be arranged in the same sequence on similar equipments.

Auxiliary switches mechanically operated by the circuit breakers, contractors, isolators, etc. shall be to approval and contacts mounted in accessible positions clear of the operating mechanism of the circuit breaker, contractor, isolator, etc., and they shall be adequately protected against accidental electrical shock.

Auxiliary switches shall be provided to interrupt the supply of current to the trip coil of each circuit breaker and contractor immediately the breaker or contractor has opened. These auxiliary switches shall make before the main contacts, during a closing operation.

A minimum of four spare auxiliary switches, two normally open, two normally closed shall be provided for each circuit breaker, and contractors and also for isolators.

4.25 TRANSISTORIZED ELECTRONIC EQUIPMENT

Transistorized electronic equipment shall comply with the BS 9000 series or equipment National Specification and be adequately sized and derated to suit the local climatic conditions.
Wiring boards shall comply with BS 4584 Part 2. Unless otherwise approved, epoxy resin-bonded fiberglass boards shall be used. The conductors shall be not less than 0.4 mm wide and the spacing shall be as follows:-

Maximum Peak Working Volts Between Conductors Volts (peak)	Maximum Spacing mm
0.5	
1.0	
2.0	
4.0	

External connections from the boards shall be soldered, crimped or through plug and socket connections to approval.

The identification of components in boards shall comply with BS 9000 or equivalent National Specification and the identification of individual boards shall be agreed with the Employer.

Where boards are mounted in racks they shall conform to 483 mm wide module unless otherwise agreed. The location of individual boards within the racks shall follow a logical pattern, boards for similar duties being arranged in similar order.

4.26 ALARM EQUIPMENT

Where an alarm system is specified, it shall consist of an initiating device, a display unit and push buttons mounted on the front of the appropriate control panel, together with a continuously rated audible warning device flasher unit and relays. The relays shall wherever possible, be mounted inside the same panel; where the number of alarms to be displayed makes this impracticable, a separate alarm relay cubicle or cubicles will be considered as an alternative.

Where is is necessary to differentiate between the urgency of alarms then various approved alarm tone device shall be provided in this Contract. In addition and where specified an alarm beacon to the approval of the Employer shall be provided.

The display unit shall consist of a rectangular frame or bezel enclosing the required number of individual facias, each of which shall be preferably approximately 32mm x 25mm in size. Each facia shall be in the form of a window inscribed with the specified

legend, describing the fault condition to be indicated. Lamps shall not illuminate adjacent windows.

At least 3 spare ways shall be provided on each display unit. All unused ways in a display unit shall be fully equipped and the alarm system designed to enable these ways to be utilized at a future date.

Alarm relays shall be of a type to the approval of the Employer, arranged to plug into fixed bases, either singly or in groups and have positive means of retaining them securely in the service position, the bases being mounted on racks or frames which shall be hinged to allow them to be swung clear of the sides of the panel or cubicle in which they are installed in order to provide ready access.
The type of wiring used for internal connections between alarm facias and their relays and between relays and terminal blocks, shall generally comply with these requirements with the following exceptions:-

(i) Single-strand wire, not less than 0.85 mm in diameter may be used.
Soldered terminations will be acceptable

External connections for alarm circuits will in general be run in multi core cables having a larger core size than that referred to above. This will necessitate special terminal blocks, if soldered terminations are used, in which case the internal and external terminations of each pair shall be joined by a removable link. Samples of the type of wire and terminal block to be used for alarm connections shall be submitted for the Employer's approval.

The operation of the alarm system shall be as follows:-

When an external alarm indicating contact closes the audible warning shall sound continuously and the appropriate facia shall be illuminated by a flashing light at a frequency which allows the inscription to be easily road.

An 'Accept' push-button shall be provided on or near the display unit, which when pressed, shall silence the audible signal and cause the facia to remain illuminated steadily.

The alarm circuit shall be designed to retain the indication after the re-opening of the initiating contact, requiring a separate 'Reset' push button to be pressed before the alarm is cancelled.

A 'Test' push button shall be fitted close to the 'Accept' and 'Reset' buttons, to illuminate all the facias on the associated display unit for as long as the 'Test' button is held depressed.

The operation of the 'Accept' button shall not preclude the receipt of further indications giving more audible alarm and visual indications as the result of the operation of other sets of alarm contacts.

Relays shall not be continuously energized when the alarm system is at rest.

For all alarm indication initiating device a spare set of voltage-free contacts shall be provided (this may be by the use of auxiliary relays) and connected by cable to a suitable, approved marshalling cubicle. These spare contacts will provide for the transmission of the alarm indication signals to the remote Grid Control Centre.

The Contractor shall be responsible for providing all the alarms required for the safe and efficient operation of the plant. General descriptions of alarms requirements are given in the specification, and the Contractor shall include any other alarms that are necessary due to the type of equipment and design of the plant to the Employer's approval.

4.27 PANELS, DESKS, KIOSKS AND CUBICLES

4.27.1 General Requirements

Unless otherwise specified, panels, desks and cubicles, shall be of floor-mounted and free-standing construction and be in accordance with the specified enclosure classification. All control and instrumentation panels shall be identical in appearance and construction.

Panels shall be rigidly constructed from folded sheet steel of adequate thickness to support the equipment mounted thereon, above a channel base frame to provide a toe recess. Alternatively a separate kicking plate shall be provided.

Overall height, excluding cable boxes, shall not exceed 2.5 m. Operating handless and locking devices shall be located within the operating limits of 0.95m and 1.8m above floor level. All panels shall be fitted with padlocks. The minimum height for indicating instruments and meters shall be 1.5m unless otherwise specified.

All panels desks and cubicles shall be vermin and insect proof. All cable entries to equipment shall be sealed against vermin as soon as possible after installation and connecting-up of the cables to the approval of the Employer.

Ventilation shall be provided for natural air circulation. All control equipment shall be designed to operate without forced ventilation.

For outdoor equipment, metal-to-metal joints shall not be permitted and all external bolts or screws shall be provided with blind tapped where a through hole would permit the ingress of moisture. All metal surface shall be thoroughly cleaned and particular care taken during painting to ensure that both internally and externally a first class cover and finish is achieved. For harsh environments, all nuts, bolts and washers shall be plated.

Door sealing materials shall be provided suitable for the specified site conditions. Doors shall be fitted with handles and locks. The doors shall be capable of being opened from

within the panel without the aid of a key after they have been locked from the outside. Hinges shall be of the life-off type. Seals shall be continuous or with only one joint.

The bottom and/or top of all panels shall be sealed by means of removable gasketted steel gland plates and all necessary glands shall be supplied and fitted within the Contract.

Panels shall be suitably designed to permit future extension wherever appropriate or specified without the need to dismantle the existing panels.

Each panel shall include rear access doors and door-operated interior lamp, and be clearly labeled with the circuit titled at front and rear, with an additional label inside the panel. Panels sections accommodating equipment at voltages higher than 110 V shall be partitioned off and the voltage clearly labeled. Each relay and electronic card within panels shall be identified by labels permanently attached to the panel and adjacent to the equipment concerned. Where instruments are terminated in a plug and socket type connection both the plug and the socket shall have permanently attached identifying labels.

Instrument and control devices shall be easily accessible and capable of being removed from the panels for maintenance purposes.

For suites of panels inter-panel bus-wiring shall be routed through apertures in the sides of panels and not via external multi core cabling between the panels.

All panels, whether individually mounted or forming part of a suit, shall incorporate a common internal copper earthing bar onto which all panel earth connections shall be made. Suitable studs of holes to the Employer's approval shall be left at each end of the bar for connection to the main station earthing system.

Earth connection between adjacent panels shall be achieved by extending the bar through the panel sides and not by interconnecting external cabling.

Cubicles and cubicle doors shall be rigidly constructed such that, for example, door mounted emergency trip contacts can be set so that mal-operation will not be possible due to any vibrations or impacts as may reasonably be expected under normal working conditions.

4.27.2 Indicating Lamps

All new indicators shall have a minimum continuous burning guaranteed life of 10000 hrs, at their rated voltage.

Indicators shall be of the filament lamp, LED or preferably noon type and shall be to approval by he Engineer.

Indicators shall be easily replaceable from the front of the panel and. shall be adequately ventilated.

LED indicators shall operate at not less than 20mA and red LED indicators shall be of the high brightness types.

The lamps shall be clear and shall fit into a standard form of lamp holder. The rated lamp voltage should be ten percent in excess of the auxiliary supply voltage, whether AC or

DC. Alternatively, low voltage lamps with series resistors will be acceptable, however resistors shall be dimensioned to avoid damage due to heat.

The lamp glasses shall comply with BS. 1376 and BS. 4099 or equivalent National Standard and shall be in standard colours, red, green. blue, white and amber. The colour shall be in the glass and not an applied coating and the different coloured glasses shall not be interchangeable. Transparent synthetic materials may be used instead of glass, provided such materials have fast colours and are completely suitable for use in tropical climates.

Normally energized indicating lamps, if employed, shall in general be energized from the station LVAC supply.

Lamps and relays incorporated in alarm facia equipment shall be arranged for normal operation from the station battery, subject to the approval of the Employer.

Lamp test facilities shall be provided so that all lamps on one panel can be tested simultaneously by operation of a common push-button. Where alarm facias are specified, all alarm and monitoring indications (apart from circuit-breaker and disconnector position indications) shall be incorporated in the facia.
Where specified every circuit breaker panel shall be equipped with one red and one green indicator lamp, indicating respectively circuit closed and circuit open and an amber lamp for indicating ‘auto-trip’. Where specified in the lines of mimic diagrams, indicating lamps may be of the three-lamp single-aspect type.

All lamps shall be renewable from the front of panels without the use of special tools.

The variety of indicating lamps provided shall be rationalized to reduce maintenance and spares requirements.

4.27.3 Anti-Condensation Heaters

All switchboards, panels, cubicles, motor control centers and the like shall incorporate electric heaters capable of providing movement of sufficient heated air to avoid condensation. The power supply to the heaters shall be manually switched by a two pole switch with red lamp. All heaters on multi-panel equipment shall be controlled from a single point. The related equipment shall be designed to accept the resulting heat input.

Bus wiring shall be incorporated in switchboards for supplying the heaters.

4.28 PANEL WIRING AND TERMINAL BOARDS

4.28.1 General

All electrical equipment mounted in or on switchgear, panels, kiosks, and desks, etc. shall have readily accessible connections and shall be wired to terminal blocks for the reception of external cabling.

All wiring shall be of adequate cross-sectional area to carry prospective short-circuit currents without risk of damage to conductors, insulation or joints.
All cabling shall be of type CR or CK to BS 6231 unless the design of the plant requires the cabling to withstand more onerous operating conditions in which case cabling shall be suitable for these conditions. The minimum cross section of wire shall be 2.5 sq.mm.for all secondary wiring associated with current transformers of nominal secondary rating of 0.5 A or greater. The size of wiring for circuits other than CT secondary wiring shall be not less than 1.5 sq.mm. cross-sectional area, save as permitted in the specification.

The minimum strand diameter of copper or tinned copper flexible conductors shall be 0.20 mm for flexible and the minimum cross-sectional area shall be 0.5 sq.mm. for all cables. For wiring within panels on circuits not directly associated with circuit breaker protection and control, and having a continuous or intermittent, load current of less than 1 amp, the use of smaller line down to 0.25 sq. mm. will be permitted subject to Employer's Approval.

Where an overall screen is used, this shall be metallic screen or low resistance tape, with drain wire as above.

Wiring shall be supported using an insulated system which allows easy access for fault finding and facilitates the rapid installation of additional cables.
Small wiring passing between compartments which may be separated for transport shall be taken in terminal blocks mounted near the top of each compartment, separately from those for external cable connections.

Both ends of every wire shall be fitted with ferrules of insulating material complying with BS 3858 or equivalent National Standard and engraved in black. The identification numbering system used for the ferrules shall be to the approval of the Employer. Where new equipment must interface with existing equipment double ferruling shall be employed if the two numbering system are not compatible.

Connections to apparatus mounted on doors, or between points subject to relative movement, shall be made in cable type CK to BS 6231, arranged so that they are subjected to torsion rather than bending.

4.28.2 Identification of Cable Cores

Where a wire a multi core cable passes from one piece of equipment to another, e.g. from a circuit breaker to a remote control panel, the Contractor shall ensure that the identity of

the wire is apparent at both ends and intermediate marshalling points by the use of ferrules, which shall permit identification of the cable in accordance with the schematic diagrams. The ferruling system to be adopted shall be a composite marking method to IEC 391 and BS 3858 as appropriate, giving both functional information on the purpose of the individual conductor plus dependant both-end marking.

Should the Contractors normal practice be at variance with the requirements of this Clause he may submit details of the scheme proposed for consideration by the Employer. The Employer is not obliged to accept the Contractors proposal.

Each core of multi paier wiring shall be identified by colour and terminal block identification together with an identification tracer per bundle.

Permanent identification of all terminals, wires and terminal blocks shall be provided. Each individual terminal black shall have independent terminals for incoming and outgoing cabling.

4.28.3 Terminals and Terminal Boards

Terminal Assemblies shall be of the unit form suitable for mounting on a standard assembly rail, to give the required number of ways. The units shall be spring retained on the assembly fail. Each individual terminal block shall have independent terminals and outgoing cabling.

End barriers or shields shall be provided for open sided patterns.

It shall be possible to replace any unit in an assembly without dismantling adjacent units. Moulding shall be mechanically robust and withstand the maximum possible operating temperatures and torque which may be applied to terminal screw. All live parts shall be recessed in the moulding to prevent accidental contact.

Terminals shall be of the screw clamp type for lower current rating which compress the conductor or termination between two plates by means of a captive terminal screw. Contract pressure of screw clamp terminations shall be independent of each other. For higher current ratings bolted type terminals are permitted. Current carrying parts shall be non-ferrous and plated.

All terminals for ‘incoming’ cabling shall have testing facilities, which permit the examination of the state of the circuit without disconnecting the associated cabling. Terminal blocks for current transformer secondaries shall be fitted with shorting/disconnect facilities.

Terminal blocks for voltage transformers secondaries shall be isolatable.

Terminal blocks in telemetry marshalling cubicles shall be isolatable. The means of isolation shall be fixed and give visual identification of the status of the terminal.

No more than 1 wire shall be connected to each terminal and cross-connection facilities shall be provided where numerous cores are to connected together.

Each terminal block, and every individual terminal shall be identified. The terminal identification number shall be included on associated schematic and wiring diagrams.

The mounting rail may only be used to provide an earth connection, when firmly bonded to the earth bar to the Engineers approval.

The Contractor shall submit samples of the terminal blocks/mounting rail assemblies together with details of his proposed cabling/termination system to the Engineer for approval.

Adjacent terminals to which wires of different voltage, polarity or phase are connected shall be separated by a protruding insulating barrier; this requirement also applies to terminals carrying wires of the same voltage but originating from different sources.

Wires shall be grounded on the terminal boards according to their functions. Terminal blocks for connections exceeding 110V shall be fitted with insulting covers.

Terminal blocks shall be mounted not less than 150 mm from the gland plates, and spaced not less than 100mm apart, on the side of the enclosure.

Sufficient terminals shall be provided to permit all cores on multi core cables to be terminated. Terminals for spare cores shall be numbered and be located at such position as will provide the maximum length of spare core. At least 10% spare terminals shall be provided in all cases.

The tails of multi core cables shall be bound and routed so that each tail may be traced without difficulty to its associated cable. All spare cores shall be made off to terminals.

When two lengths of screened cable are to be connected at a terminal block (i.e. junction box) a separate terminal shall be provided to maintain screen continuity.

Should the terminal block manufacturer recommend that specific types of terminal tools are used (eg parallel sided screwdrivers) the contractor shall provide three sets of these at each sub-station site. In addition the contractor shall provide 8 number, test leads of minimum 1500mm length which can be inserted into the test terminals of the terminal blocks, at each sub-station. The test leads shall be capable of being ‘jumpered’ together for multi-instrument use.

The use of pre-formed factory tested cable connections to field mounted marshalling boxes shall be to the Employer’s approval.

4.29 JUNCTION, TERMINATION MARSHALLING BOXES, OPERATING CUBICLES ETC.

All junction, termination and marshalling boxes shall be of substantial sheet steel construction, having enclosure classification in accordance with Section 4.4.17.9 and

fitted with external fixing lugs and finished in accordance with this Specification for cleaning, painting and finishing. The boxes shall allow ample room for wiring, with particular regard to the deployment of wires from the point of entry.

Outdoor boxes shall have internal anti-condensation heaters and stay bars fitted to doors. Indoor boxes shall be designed such that any condensed water cannot affect the insulation of the terminal boards or cables. No cables shall be terminated into the top of outdoor boxes unless specifically approved by the Employer.

Each box shall be complete with suitably inscribed identification labels.

Any outdoor boxes, cubicles etc containing instruments or meters shall have glazing suitable to permit the visual examination of these.

Covers shall be arranged for padlocking and padlocks with keys shall be supplied. Cast iron boxes shall have bolted lids requiring the use of special keys or spanners for removal.

All boxes shall be provided with adequate earthing bars and terminals.

Notwithstanding information supplied by the Employer, the Contractor shall, as each box is completed or at intervals as requested by the Engineer, supply to the Employer copies of accurate termination or destination charts showing the as-fitted arrangement of cables and cores in each box. The Contractor shall, following the Employer's approval, fit one plastic laminated copy of the appropriate chart to the interior of each box.

4.30 CONDUIT AND ACCESSORIES

Conduit, accessories and trunking installation shall comply with the latest issue of the Institution of Electrical Engineers Regulations for the Electrical Equipment of Buildings, unless otherwise approved by the Employer. In addition installation shall also comply with all local electricity regulations.

Unless otherwise approved, all conduit and conduit fittings shall be galvanized, of heavy gauge steel, screwed, solid drawn or weld type complying with IEC 423 and IEC 614.

No conduit smaller than 19mm outside diameter shall be used.

Standard circular boxes or machined face heavy duty steel adaptable boxes with machined heavy type lids shall be used throughout. For outdoor mounting all boxes shall be galvanized, weatherproof and fitted with external fixing lugs.

Conduit terminations shall be fitted with brass bushes.

The use of running threads, solid elbows and solid tees will not be permitted.

Conduit ends shall be carefully reamed to remove burrs. Draw-in boxes shall be provided at intervals not exceeding 10m in straight-through runs.

Conduit runs shall be in either the vertical or horizontal direction unless otherwise approved and shall be arranged to minimize accumulation of moisture. Provision for drainage shall be made at the lowest points of each run.

Conducts shall be supported on heavy galvanized spacer saddles so as to stand off at least 6mm from the fixing surface.

Provision shall be made for the support of internal conductors in instances where the length of the vertical run exceeds 5m.

All conduits run in any circuit are to be completed before any cables are pulled in.

Flexible metallic conduit shall be used where relative movement is required between the conduit and connected apparatus, and a separate copper connection provided to maintain earth continuity.

The maximum number of cables in any conduit shall be in accordance with the latest issue of the IEE Regulations for the Electrical Equipment of Buildings.

4.31 TRUNKING

Steel trunking etc. may be used for running numbers of insulated cables or wires in certain positions to the approval of the Engineer. The trunking thickness shall not be less than 1.2mm.

4.32 ELECTRIC MOTORS

4.32.1 General

Motors shall comply with the requirements of IEC 34, IEC 72/72A, BS 4999 and BS 5000 as applicable. All motors shall, unless otherwise agreed by the Employer, be of the same manufacture and shall be of the three phase type for ratings above 1 kW.

The rating of meters shall be based on the specified maximum ambient temperature, taking consideration of solar radiation for outdoor motors unless adequate shade is provided. Calculations shall be submitted to show due allowance for ambient temperature and solar radiation when considered necessary by the Employer.
The Contractor shall provide motor schedules showing at least starting current and power factor at 100% and 80% voltage, running, current, efficiency, power factor at 100%, 75% and 50% full load, manufacturer, and all other motor ratings plate data for all AC and DC motors, with appropriate circuit designations and plant record number.

4.32.2 Type and Rating

All AC. motors, except where otherwise specified, shall be of the constant speed, cage induction type, with windings adequately braced for direct-on-line starting at the rated voltage using their associated circuit breaker or contractor.

Motors shall be continuously rated to IEC 34 as applicable. Exceptions shall be permitted only when the intermittent duty cycle can be accurately defined by the Contractor.

The rating of the motors shall be a minimum of 10% in excess of the most onerous associated mechanical duty.

4.32.3 Insulation

Motors shall be insulated with materials complying with IEC 85. Class F insulation shall be used with the temperature rise not exceeding the limits applicable to Class B.

4.32.4 Starting Current

Unless otherwise specified or required the maximum starting current characteristic classification shall be in accordance with Design B of Table 41.3.1. of BS 4999 Part 41.

The tolerances applicable to the specified characteristics shall conform to the requirements of BS 4999 Part 61.

4.32.5 Conditions of Operation

The motors shall be capable of continuous operation under the site service conditions specified at any frequency variation between + 2% and – 4%, and voltage variations of ± 15%; the maximum voltage and frequency variations may occur simultaneously.

All motors shall also be capable of supplying the starting and most onerous operating load conditions of the driven unit such as open fan vane or open discharge valves, at 80% of the rated voltage for a time at least twice the normal starting time.

4.32.6 Motor Torque

The locked rotor torque of cage induction motors shall be adequate to meet the specified requirements of the driven load, but in any event shall be not less than the values given in IEC 34 Part 12 for "Design N" motors.

The accelerating torque, defined as the difference between motor output torque and driven load torque, at any speed and with 80% rated voltage applied, shall not be less than 10% of motor rated full-load torque. In any event the motor accelerating and run-up torque at 100% rated voltage shall be not less than 1.7 times the torque obtained from a

hypothetical load curve which varies as the square of the speed and is equal to 100% torque at rated speed.
The margins between the torques of the motors and driven plant shall include e suitable allowances for impeller wear, fouling etc., during the life of the plant.

4.32.7 Bearings

Bearings shall be designed to ISO 281/1 and be of the ball or roller type unless otherwise approved by the Engineer. They shall exclude the ingress of dust and water and sealed to prevent leakage of lubricant along the shaft. (Preference will be given to pre-packed bearings).

Bearings equipped for grease-gun type lubrication shall have grease nipples located in accessible positions and of an approved pattern, and should be provided with dust proof grease escape valves on the bearing housings.

Irrespective of rating, motors which may be stationary for long periods during normal operation of the plant shall be designed to withstand vibration from an external source.

Sleeve type bearings should be lubricated by two oil rings or other approved device running in an oil bath of adequate capacity, having filling, inspection and draining facilities, together with an oil level indicator.

Thrust bearings shall be to approval

Motors supplied with independent bearings shall be mounted with the bearings on a common bedplate.

When forced lubricated bearings are necessary, these shall be supplied from a self-priming oil pump driven from the main shaft. There shall be adequate lubrication during start up and rundown, motor driven auxiliary oil pumps shall be provided as necessary. Details of all forced lubrication systems shall be to approval.

4.32.8 Methods of Cooling

The degree of enclosure protection for motors shall be in accordance with Section 4.4.23.2.

The method of cooling for motors shall be in accordance with IEC 34.6 unless otherwise approved by the Employer.

Drain plugs, accessible in the motor service position, shall be provided at a low point on all motors and their associated coolers to permit drainage of any condensate.

4.32.9 Noise and Vibration Limitations

The noise and vibration limitations of motors shall conform with the requirements detailed in VDE 0530 1/69 and VDE 2056 respectively as appropriate.

4.32.10 Terminals and Terminal Boxes

Terminals and terminal leads shall be to approval and substantially designed for connection to the electrical system and shall withstand the maximum system symmetrical fault level.

Electrical clearances and creepage distances shall comply with IEC 34 or IEC 72 as appropriate. These clearances and creepage distance shall apply also to insulated terminals and connectors.

The enclosure classification of terminal boxes shall be the same as that specified for the motors. Joints shall be flat and parallel and provided with sealing gaskets of an approved material.

4.32.11 Earth Terminal

All motors shall be provided with an earthing stud or bolt of adequate size for the related system earth fault current and physically to suit the earth conductors for earthing the frame. The terminal shall be marked in accordance with IEC 117.1.

4.32.12 D.C. Motors

DC. motors shall be capable of continuous operation under the service conditions at any voltage between ± 10% of the nominal DC. system voltage.

All DC motors shall be provided with brush gear which does not require to be moved to suit load conditions.

The associated motor over-current protection shall not trip the motor but shall initiate an alarm.

Motors connected to rectifier equipment shall meet the conditions of supply voltage and frequency specified for a.c. motors where necessary, and shall be designed to withstand the maximum levels of ripple and harmonics continuously without deleterious heating.

4.33 MOTORS STARTERS AND CONTACTORS FOR SEPARATE MOUNTING

Contactors shall be of robust design and shall comply with IEC 158 and shall include isolating facilities.

All contactors and their associated apparatus for minor motors shall be capable of operating without overheating for all specified motor operating conditions, and including for a period of five minutes at normal frequency if the supply voltage falls to 80% of nominal voltage.

4.34 PUSH-BUTTONS AND SEPARATELY MOUNTED PUSH-BUTTON STATIONS.

Push-buttons shall be shrouded or well recessed in their housings in such a way as to minimize the risk of inadvertent operation.

The colour of push-buttons shall be black unless otherwise required by the Employer.

Push-button stations supplied as loose equipment shall be of the metal clad weatherproof type suitable for wall or bracket mounting.

Each push-button station shall be clearly labeled showing the duty or drive to which it is applicable.

4.35 PORTABLE FIREFIGHTING APPARATUS

Portable firefighting apparatus as specified shall be for the suppression of major and minor fires in the sub-station building and outdoors in the switchyard generally.

The portable apparatus shall be suitable for use by one person alone and shall be suitable for conveniently recharging on Site.

The extinguishers shall be suitable for use on oil or electrical fires and shall not include toxic gases or corrosive fluids. Toxic gases shall not be emitted by the discharge when heated.

The portable extinguishers shall be in three categories:

Approximately 150 liters (35 gallons) capacity portable foam fire extinguishers for oil fires.

Approximately 10 liters (2 gallons) capacity hand type foam fire extinguishers for oil fires.

Approximately 1 kilogram (2.51b) charge hand held CO_2 fire extinguishers for with trigger action for electrical fires.

Suitable recharges shall be supplied for the foam extinguishers and replacement cylinders for the portable CO_2 extinguishers.

The larger extinguishers shall be provided with approved wheeled trolley suitable for use over the stone chipping surface of the outdoor sub-station.

Permanent Sun shade structures shall be provided for outdoor wheel mounted fire extinguishers.

The hand held extinguishers shall be complete with wall brackets and fittings to be positioned to the Employer’s approval.

Full details of the equipment shall be included in the Tender.

4.36 STANDARDS

In the technical specification reference have been made to various clauses of IEC ; BS; ISO and ASTM standards. Where any standard referred to in this specification has been superseded by a new standard the reference shall be deemed to be to such superseding standards. Notwithstanding the standard numbers mentioned in the technical specification the Bidders are directed to apply the latest published editions of these standards.

Deviations from the specified standards referred to above shall be given in the Schedule of Proposed Standards at section – 7 and shall have to be accepted by the Employer before contract placement.

4.37 NOMINAL SAFTY CLEARANCE

NOMINAL VOLTAGES BETWEEN PHASES	33 kV
-MINIMUM CLERANCE BETWEEN LIVE PART AND EARTH	381
-MINIMUM CLERANCE BETWEEN LIVE FIXED METAL OF DIFFERENT PHASES	432
-MINIMUM TOTAL AIR GAP BETWEEN TERMINAL OF THE SAME POLE OF DISCONNECTORS	432
-MINIMUM SAFETY CLEARANCE BETWEEN LIVE METAL AND POSITIONS TO WHICH ACCESS IS PERMISSIBLE WITH OTHER EQUIPMENT ALIVE	2740
-CLEARANCE FROM GROUND TO NEAREST PART NOT AT EARTH POTENTIAL OF AN INSULATOR SUPPORTING LIVE CONDUCTOR	2440

5.0 SPECIFICATION OF SWITCHGEAR AND ASSOCIATED EQUIPMENT

5.1 33KV OUTDOOR TYPE CIRCUIT BREAKERS

5.1.1 General

The 33kV outdoor circuit breakers shall be of vacuum type in accordance with BS 5311 or IEC 56 or the latest version IEC 62271-100 as appropriate.

Circuit breakers shall be covered by type-test certificates issued by a recognized short circuit testing station certifying the operation of the circuit breaker at duties corresponding to the rated breaking capacities of the circuit breakers. The test duty shall

not be less onerous than the requirements of BS 5311 and IEC 56 Sections 1-6 with respect to transient recovery voltage, breaking under short line conditions and for breaking under system charging current conditions. Where any modification was made to the test connections to control the rate of rise of recovery voltage, full particulars shall be provided and the acceptance of such tests shall be at the Employer's discretion.

Circuit breakers must be capable of interrupting without damage and without initiating surge voltages exceeding 150% of the rated normal peak voltage produced by the out-of-synchronism conditions associated with auto-reclosure, the switching of transformer magnetizing currents and of unloaded underground cable charging currents. Test certificates shall be submitted by the Tenderer to demonstrate the ability of the circuit breakers of switching an unloaded underground cable.

Any device incorporated in a circuit breaker to limit or control the rate of rise of restricting voltage across the circuit breaker contacts shall likewise be to the Engineer's approval and full descriptions of any such device shall be given.

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Circuit breakers shall be designed for minimum maintenance and adjustment of the mechanism, maintenance shall not be required at intervals of less than 1000 normal operations. It may be assumed that the circuit breakers will be tripped at least once every six months. Regular maintenance shall not be required at less than 5 years or 1000 mechanical operations whichever is the earlier. Major overhaul of the interrupter assemblies and mechanisms after short circuit shall be determined on the basis of performance during short circuit type tests.

The Manufacturer shall state, in the attached schedules, the number of operations under full short circuit conditions after which overhaul and adjustment will be required.

Means shall be provided to allow easy access to the contact/interrupter assemblies for inspection and maintenance purposes. All contact/interrupter assemblies shall be readily and quickly replaceable and it shall not be possible to replace contact assemblies and complete interrupters incorrectly.

Where the circuit breaker design is used to house current transformers, sufficient space should be provided for at least five current transformers per bushing.

The Tenderer shall state the total break time for breakers as defined in IEC 56.
Circuit breakers shall be trip free as defined in IEC 56 section 1.

It shall not be possible to close or initiate the close of a circuit breaker if a trip signal is present.

5.1.2 Making and Breaking Capacities

Each circuit breaker shall be capable of making and breaking short circuit faults in accordance with the requirements of IEC publication 56 sections 1-6 inclusive and as described in the schedules.

The circuit breakers or any part of the switchgear or supporting structures shall not be permanently strained when making or breaking the rated short circuit currents.

5.1.3 Contacts, Arcing Chambers and Insulation

Circuit breaker tanks and enclosures shall be capable of withstanding the maximum possible pressures that can occur in service without leakage or permanent distortion. Tests shall be carried out by the manufacturers to demonstrate this capability and the results of these tests shall be forwarded to the Employer for approval.

Contact lift rods shall be guided to ensure smooth entry and withdrawal of the moving contacts within arc control chambers. Effective and reliable means shall be provided to absorb surplus energy at the end of the travel of the moving contacts and shall form an integral part of the circuit breakers.

Arc control chambers shall be self-contained units and shall not require dismantling for removal or replacement. The design of the arc control device shall be such as to minimize the risk of incorrect assembly and it shall not be possible to mount a complete device in other than its correct orientation.

Separate arcing contacts shall be provided on circuit breakers to protect the main contacts from burning during operation; contacts shall be easily and quickly replaced.

5.1.4 General Arrangement

Circuit breakers shall be suitable for mounting directly on supporting steelwork. Anchor bolts shall be provided and shall be of a type enabling the circuit breakers to be positioned without the necessity of jacking over the anchor bolts. The arrangement of the switchgear on the Site shall be such that adequate access for normal routine maintenance and the replacement of either a complete breaker or any component parts of the assembly shall be possible with the minimum disruption.

To facilitate transport, lifting lugs, jacking or other handling devices capable of supporting each unit when fully erected and ready for service shall be provided.

Evidence shall be provided that enclosures subject to internal pressures in excess of normal atmospheric pressure during service operation have withstood approved pressure

tests without leakage, permanent distortion or any temporary distortion such as might cause mal operation of the circuit breaker.

5.1.5 Operating Mechanisms

5.1.5.1 General

Circuit breakers for outdoor sub-stations shall have operating mechanisms of the stored energy type comprising:-

A: 33 kV switchgear, motor charged spring

Mechanisms shall be capable of fully closing and latching the circuit breaker against its rated current and shall be capable of interrupting under all conditions of short circuit in the event the circuit breaker is tripped during closing.

Circuit breaker mechanisms shall be so designed that the circuit breaker is free to open immediately the tripping circuit is energized and without the use of any additional external power and shall preferably be of the spring-operated type.

Each part of the operating mechanisms shall be of substantial construction, utilizing corrosion resistant materials where necessary to prevent sticking due to rust or corrosion. The overall designs shall be such as to reduce inadvertent operation due to fault current stresses, vibration or other causes.

An approved mechanically operated indicator easily visible from the ground shall be provided on each circuit breaker operating mechanism to show whether the circuit breaker is open or closed.

Spring operated mechanisms shall be fitted with a time delayed spring unchanged alarm and closing interlock.
Power closing mechanisms shall be recharged automatically by 230 volts AC motor for further operations as soon as the circuit breakers have completed the closing operation, and the design of the closing mechanism shall be such that the circuit breakers cannot be operated inadvertently due to external shock forces resulting from short circuit, circuit breaker operation, or any other cause.

Means shall also be provided to recharge the closing mechanisms by hand.

Circuit breakers shall be provided with slow acting manually powered operating devices for inspection and maintenance purposes only. It shall not be possible to slow close a circuit breaker when in normal service condition.

In the event of a failure of the circuit breaker to hold/latch in the fully closed position it shall not be possible for the breaker to open except at normal speed and in so operating shall be capable of interrupting its rated short circuit current and shall open fully.

Means shall be provided for the local manual “non-electrical” tripping of the circuit breaker, preferably by a shrouded push button and facilities shall be provided for locking off this means of tripping. It shall not be possible to lock mechanically the trip mechanism so as to render the electrical tripping inoperative.

A mechanically operated On/Off indicating device shall be provided to indicate whether the circuit breaker is in the closed or open position. It shall be positively driven in both directions, and shall be clearly visible with the doors of the operating cubicle closed.

5.1.5.2 Spring Charged Mechanisms

The 33kV circuit breakers shall comply with the following requirements.

A time delayed spring uncharged alarm and closing interlock shall be fitted.

The spring charge motor shall be driven by a motor wound for 230 V AC.

5.1.6 Operating Cubicles

Each circuit breaker shall be equipped with a local free standing control cubicle.

Local free-standing circuit breaker operating cubicles shall comply with the requisite clauses of the General Technical Requirements and shall contain the operating mechanisms, auxiliary switches and associated relays, contact switches, control cable terminations and other ancillary equipment. They shall be galvanized.

Access doors or panels shall be glazed where necessary to enable instruments to be viewed without opening the cubicle and shall have facility for latching in the open position. The arrangement of equipment within the kiosk shall be such that access for maintenance or removal of any item shall be possible with the minimum disturbance of associated apparatus.

An outdoor pattern switched 230 volts 13 amp single phase socket outlet and MCBs shall be mounted within the cubicle.

A lockable two position selector switch shall be provided inside the cubicle as follows:

Remote - ON/OFF control only from the sub-station control room, or from the future distribution control centre, this being the normal position with all remote control and protection circuits connected.

Local (for maintenance) - ON/OFF control only from the cubicle, this being the maintenance position with all remote control and protection circuits disconnected.

A separate motor ON/OFF switch shall also be provided for maintenance of the motor for spring, operated systems. An anti-condensation heater with switch shall be provided and the cubicle supplied with ventilation and filters.

Where practicable an approved schematic diagram of the part of the control system local to the circuit breaker, identifying the various components on the circuit breaker and referring to the appropriate drawings and maintenance instructions, shall be affixed to the

inside of the cubicle access door. The diagram shall be marked on durable non-fading material such as bonded melamine plastic or etched on metal foil.

The circuit title and identification number shall be prominently displayed on permanent labels mounted on the outside of the cubicle.

Where cubicle design permits, the necessary terminal blocks, cable glands, etc., shall be provided for the marshalling of all ancillary equipment cabling associated with the circuit breaker. Wiring shall be of type CR or CK to BS 6231, unless the contractor requires cabling to withstand more onerous operating conditions in which case suitable wiring shall be provided to the Engineer's approval.

A separate marshalling cubicle or kiosk shall be provided for marshalling equipment cabling associated with busbar selectors, line isolator switches, current and voltage transformers etc. to be routed to the remote control and relay panels.

An earthing terminal shall be provided for each piece of equipment in an approved position to enable the equipment to be bonded to the sub-station main earthing systems.

5.1.7 Motors for Circuit Breaker Mechanisms

Small h.p. motors shall be continuously rated in accordance with BS 2613. Mounting shall be in the horizontal or vertical plane-inclined motors are not permitted.

Bearings: grease lubricated ball and roller type are preferred. The use of sleeve bearings is permitted provided a separate lubrication system is not used. The bearings shall withstand any thrusts from the driven equipment and in the case of vertically mounted motors, the bearings shall be capable of supporting the weight of the rotor or armature. It shall be possible to lubricate the motor bearings without the necessity of removing the motor from its mountings. The type of lubricant used shall be readily available in Bangladesh and suitable for the application; it should not harden or change its chemical composition due to the motor being idle for long periods.

The motor shaft shall be coupled either directly to the driver equipment or via a gearbox if necessary. The use of pulleys is not permitted. The direction of rotation of the motor shall be indicated on the motor and the driven equipment by means of an arrow. The motor shall be balanced so that vibration level is within BS 2613. At no time when the motor is operating shall its speed exceed 3000 r/min, preferred maximum speed is 1500 r/min.

Each motor shall have a terminal box which shall be watertight Terminals are to be clearly marked in accordance with BS 822 Part 6.

Insulation used on all windings and in slots shall be non-hygroscopic, Class B or F complying with IEC 85. All insulation used shall be suitable for use in a tropical climate.

Anti-condensation heaters shall be provided if these are necessary to prevent the harmful accumulation of moisture in the motor. These heaters shall operate from a single phase 230 V a.c. supply.

Motors and, if applicable, heaters, shall be protected by MCBs one in each phase for 3 phase supply or on the 'line' side for single phase supply.

5.1.7.1 A.C. Motors

Motors shall be wound for nominal 400 volt, 3-phase, 50 Hz, 3 wire or 230 volt, single phase supply and be capable of operating under frequency variations of ± 5 Hz and/or voltage variations of ± 10%. Starting is to be direct-on-line.

Motors shall be of the squirrel cage induction. For squirrel cage motors, cast rotor construction is preferred. Maximum starting current shall not exceed six times full load current.

5.1.8 SPECIFICATION OF OUTDOOR 33 kV SWITCHGEAR

Sl. No.	Description	Unit	Requirements
1.	System voltage	kV	33
2.	Rated voltage for equipment	kV	36
3.	Type of switchgear	--	Vacuum
4.	Class	--	Outdoor
5.	Number of phases	--	3
6.	Frequency (Supply)	H_Z	50
7.	Rated short circuit capacity		
8.	Symmetrical breaking current	kArms	25
	Rated short circuit making current	kAp	63
9.	Short time current duration	Second	3
10.	Rated current		
	Bus sectionalizer (Isolator)	Amperes	2000
	Feeder circuit	Amperes	1250
11.	Ambient temperature		
	Maximum	^oC	40
	Minimum	^oC	5
	Average	^oC	25
12.	Rated transient recovery voltage	--	As per IEC 56
13.	Rated operated sequence	--	O-0.3s-CO- O 3min-CO
14.	Rated insulation level		
	Impulse withstand voltage	kVp	170
	Minimum dry withstand voltage	kVrms	70
	Minimum wet withstand voltage	kVrms	40
15.	Minimum creepage path for insulators	mm/kV	25
16.	Degree of Protection		IP 55

5.2 33 kV Current Transformer

Single phase 33 kV, low oil content, outdoor CT, alongwith galvanized steel mounting structure, HV terminals fitted with suitable connecting clamps for being connected with the side equipment, weather proof housing for the secondary (LV) terminals with glands for the entry of multi core control cable, earthing leads and connector to connect with 150 mm^2 stranded cu. wire. There shall be two cores, one for protection and the other for metering. The capacity, ratio and accuracy class of the CT will be as follows:

The ratio shall be 2000-1000/5-5-5A for incoming feeders and 800-400/5-5-5A for outgoing feeders, capacity 30VA and accuracy 0.2% for each of two cores for metering and 30VA, 5P20 for the protection class.

The insulation value of the CT shall be of rated maximum system voltage (max.) 36 kV and (nominal) 33 kV, BIL 170 kV and power frequency withstand voltage (1min) 70 kV.

All other features as stated in the table of Guaranteed data schedule shall be applicable also.

5.3 33 kV Lightning Arrester

Gapless metal oxide (ZnO) type, single phase, 30 kV rms, outdoor type, lightning arrester, power frequency withstand voltage of housing 70 kV rms, lightning impulse residual voltage at rated current (10 kA) - 75kV (peak), along with the following feature:

Connecting Clamps

Galvanized steel mounting chassis complete.

c) Operating counter, grounding leads and clamp for being connected with 100 mm^2 stranded Cu-conductor.

All other features as stated in the table of Guaranted data schedule shall be applicable also.

5.4 33 kV Isolator, Off Load Type (Outdoor)

33 kV Isolator mounted on switchyard steel structure, horizontal mounted and vertical break, 3 phase, max. operating voltage 36 kV, rated arrester voltage 30 kV, rated current 2000A for incoming, 2000A for Bus sectionalizer (Isolator)
and 1250A for feeders, short circuit current 25 kA, (3sec.), 50 Hz, BIL 170 kV, manual operating type along with the following features:

a) Auxiliary contact operative through the operating mechanism of the isolator blade (9 normally) ON and 9 normally OFF contacts.

b) Terminal connecting clamps copper/brass suitable for being connected with the system.

c) Earth Pad for safety of the operating person. The operating level shall be provided with locking device. Necessary grounding points shall be provided with connector suitable for being connected with 150 mm^2 stranded Cu wire.

d) Gland for multi core control cable.

e) Complete operating mechanism installed on steel structure for easy manual operation from the ground and grounding points with connecting clamps for connecting with stranded cu wire.

f) All ferrous parts to be galvanized as per BS 729-1961.

g) All electrical auxiliaries to be housed in a fully weatherproof housing.

All other features as stated in the table of Guaranteed data schedule shall be applicable also.

5.5 33 kV Isolator with Earthing Blade for Bus and Line Side (Outdoor)

Same as above but with the added feature of earthing blade which will also hand operable from the switchyard by another handle and the operation of this earth blade will be mechanically interlocked with that of the main blade. The earth blade will be of same current rating as the main blade and shall be earthed through a 150 mm^2 (Cu) earthing conductor. Necessary aux. contacts for position indication and to provide electrical inter locking should be there.

5.6 33 kV Voltage Transformer

Single phase, oil immersed, outdoor VT, mounting on switchyard galvanized steel structure, HV terminals fitted with bi-metallic connecting clamps to be fitted with ACSR Conductor, weather proof housing for the secondary terminals with glands for the entry of multi core cable, earthing lead and connector to connect with one 150 mm^2 stranded Cu wire.

All other features stated below shall be applicable also.

1. Item	Description	Unit	Specified
1.	System Voltage	kV	33 kV
2.	Rated Voltage	kV	36 kV
3.	Rated Primary Voltage	kV	33/√3
Rated Secondary Voltage			
	Core 1	kV	0.110/√3
	Core 2	kV	0.110/√3
5.	Impulse withstand voltage (1.2/50 micro sec.)	kV	170 kV
6.	Power Frequency withstand Voltage	kV	70 kV
7.	BURDEN/CLASS		

For metering winding

Core 1	VA/cl	100 / 0.2
Core 2	VA/cl	100 / 3p

5.7 33/0.4KV, 100KVA OUTDOOR AUXILIARY TRANSFORMERS

Sl. No.	Description	Unit	Requirements
1.	Rated power	kVA	100
2.	Type of cooling		ONAN
3.	Principal tapping		
	High voltage	kV	33
	Low voltage	V	415
4.	Vector symbol		Dyn 11
5.	Type of tap changer		Off circuit
6.	Tapping range		± 5%
7.	Tapping steps		2.5%
8.	Number of windings		2
9.	Insulation		to IEC 76
10.	Number of phases		3
11.	Frequency (supply)	Hz	50
12.	Impedance voltage at 75°C and normal ratio		5%
13.	Terminal arrangements		
	HV terminals		Outdoor bushings
	LV terminals (3-phase 4-wire)		Cable box

5.8 LV AC Distribution Panel

Vermin and dust proof, completely metal enclosed by sheet steel (11 u.s.s gauge) with necessary reinforcement, colour grey with appropriate spray painting, free standing type, compact in size, suitable for opening at the back by hinged door with locking device.

There shall be a 3 phase 400 A, 1 kV bus (cu) arrangement with Neutral bus being connected with the following MCCBs and instruments:

i) Voltmeter with 6 position selector switch connected to the bus.

ii) Ammeter with selector switch

iii) kWh meter for each transformer

v) Two × 400 A, 4 Pole MCCB being interlocked with each other, operative one at a time to bring the Input Power to the Bus.

iii) 10 × 60 A, 3 Pole MCCB as outgoing or as required.

iv) 10 × 30 A, 3 Pole MCCB as outgoing or as required.

All MCCBs are provided with over load setting and short circuit tripping device.

Necessary terminal blocks and glands/openings shall be provided for the entry of suitable cables.

All equipment/instruments inside the panel shall be arranged neatly and sufficient space shall be provided for easy approach to each equipment/instrument.

Thermostat control panel heater, bulb for inside illumination of panel shall be provided.

All other features as stated in the table of guaranteed data schedule shall be applicable also.

5.9 DC Distribution Panel, Battery set and Battery Charger (110v)

5.9.1 DC distribution panel

The Contractor shall provide fully comprehensive d. c. systems at all new sites or where otherwise required in the schedules. The capacity of the batteries installed be adequate to meet the load-duties of the plant provided in accordance with the requirements of this Specification plus all additional circuits shown as future on the drawings or in the schedules.

Completely separate d. c. systems are required for the following duties:

33 kV Switchgear Tripping, protection, alarms, indication etc. 110 V
Emergency lighting (if required by the Contractors design)

Each Switchgear d. c. system shall comprise duplicate 100% chargers with two 50% Battery banks, designed to operate for a standby period of 8 hours. Emergency lighting systems, if proposed, shall comprise a single 100% charger and battery units.

There shall be two cu-bus, 200 A rated, 1 kV insulation

A D.C Voltmeter 0-250 V shall be connected to the bus.

Two x 100 A MCCB (2 Pole) will be the Incomings. Each of the Incoming shall have ammeter (centre zero) to indicate the flow of current.

15 Nos. of 15A-30A MCB (two pole) will be the outgoings

An earth fault detection equipment on each bus-bar to give local indication and remote alarm of the occurrence of an earth fault and to give discrimination between positive pole & negative pole earth faults.

All other features as stated in the table of guaranteed data shall be applicable also.

5.9.2 Sub-Station Battery

Application	:	**Supply for Remote Control, operation, Indication, Protective and Regulation apparatus, Emergency light etc.**
Installation	:	
Type	:	Indoor (self supporting unit)
Operating Voltage	:	Nickel Cadmium
Continuous discharge	:	110 V, D.C.
Capacity (at 5 hr. rate)	:	10 A during 10 hour
No of cell	:	250 Ampere hour
Discharging voltage	:	92
Charging voltage (Float)	:	1.0-1.42 Volt per cell
Charging voltage (Boast)	:	1.4-1.42 Volt per cell
Type of container	:	1.54 -1.69Volts per cell
Mounting	:	Transparent plastic
Construction	:	Cabinet
Standard	:	Closed top
		All equipment and materials shall be designed, manufactured and tested in accordance with the latest editions of applicable IEC standard unless otherwise specified in the specification. Other internationally acceptable standards will also be considered provided that relevant values are at least similar to those under IEC standards.

Features and Accessories:

The battery shall be Nickel Cadmium Alkaline type, negative plates shall have life equal to or greater than positive plates.

The battery shall have built in protection against active materials shedding and grid corrosion and shall be assembled in heat-resistant, shock-absorbing, containers. The containers and covers are connected together to form a leak proof bond against seepage of electrolyte.

Battery Type

The batteries shall be of high performance nickel cadmium pocket plate type complying with IEC 623:1978 and shall be designed for a life expectancy of at least 25 years under the conditions of service likely to be encountered by the equipment detailed in this Specification. A complete set of test maintenance accessories suitably boxed, shall be provided for each battery installation. A syringe hydrometer and durable instruction card shall be include in each set.

Battery cases shall be of high impact translucent plastic.

The electrolyte shall be free from impurities and the potassium Hydroxide used shall comply with BS 5633: 1978. Dilution of the alakaline electrolyte and topping up of cells shall be carried out using distilled water only.

Cells shall be permanently marked with the following information:

Manufacturer's reference number and code
Year and month of manufacture
Voltage and nominal capacity at the 10 hour discharge rate.

Battery and DC System Voltages

The nominal dc. voltage for all battery systems installed under this contract shall be 110V for Switchgear systems.

The d. c. system shall prevent the boost-charging voltage appearing on the distribution equipment and substation plant.
All d. c. energized apparatus is to be adequately rated to operate over a voltage range of 80% to 110% of nominal d. c. voltage, apart from circuit breaker shunt opening releases which shall operate between 70% and 110% of nominal d. c. voltage in accordance with ICE 56.3 and IEC 694.

The battery capacity however, shall be designed to operate over a voltage range of +10% to 15% of nominal dc voltage. All secondary cabling shall limit the maximum volt-drop to 5% at peak load, measured from battery terminals to individual items of plant.

The rating of each battery shall be sufficient to met the total electrical loading of the system for all equipments including an allowance for all future items requiring battery supply and make adequate provision for manufacturing tolerances and diversity factors. The following criteria shall be adopted and the calculations shall observe fully the requirements of Clause 43 of BS 162.

The rating of each battery shall be on the basis as specified and is subject to adjustment after award of contract such that when charged to its rated capacity at the start of the duties, it shall be sufficient to supply the demands with the charger disconnected for the specified period of time, and be capable of closing each CB consecutively and then tripping all circuit breakers simultaneously at the end of this period.

At the end of all these duties the battery voltage shall not have dropped such that the voltage at the battery terminals falls below 85% of the nominal system voltage when supplying the standing load.

In addition the voltages at the terminals of all components in the system (e.g. relays, trip and closing coils) shall not be outside of the individual voltage limits applying to them.

All quantities used in estimating the battery capacity shall be submitted for consideration but shall not be used for procuring materials until specifically approved by the Employer

The electrolyte capacity and general design of the batteries shall be such that inspection and maintenance, including topping up of all electrolyte shall be at intervals of net less than twelve months.

Duties

The rating of each battery shall be determined by ten Contractor to meet the requirements of the duty cycle of each system.

Where the capacity of a battery is described as a percentage (e.g. 50%), this percentage is deemed to refer to the product of the total d. c. load current on the distribution switchboard and the specified discharge period. Should the d. c. load current vary during the discharge period, a mean value may be used for calculation of battery capacity, providing the average is suitably weighted to take account of the apparent loss of capacity which will occur during period of a high rate of discharge.

5.9.3 Battery Charger

Rectifier type	:	Thyristor
Nominal output voltage	:	110 D.C.
Input voltage	:	415 V, 50 Hz, 3 phases.
Charging operating	:	Boost and floating charge,

control automatic with manual operation.

Maximum charging current : 5./0 A (D.C.)

Provision for constant current 15A-40A shall be provided
Provision for constant voltage 90 V-130 V shall be provided

Feature and Accessories:

- All interconnections, nuts and bolts shall be non-corrosive type.

- Battery charger with a voltmeter (0 to 250V D.C. scale) and dual scale ampere meter (50- 0-50 Amp.), both flush pattern type with 4 inch (approx.) dials.

- The unit shall have setting knobs for constant charging current within the specified range and constant voltage within the specified range.

- Necessary accessories for battery charger, such as small wiring fuses, terminals, block switches and miscellaneous.

- Appropriate tamper proof sheet steel housing for battery charger.

- The housing shall have storage space for accessories and provision for locking.

Necessary interconnections between battery and battery and battery charger, D.C. output terminals, A.C. input terminals and A.C. disconnect switch.

The cell terminal posts of the inter-cell and end cell connectors shall have adequate current carrying capacity and shall be of lead alloy or lead alloy reinforced with copper inserter. The container shall be filled with sufficient quantity of Alkaline solution complying with Internationally acceptable standards to ensure that the surface of Alkali is leveled with the level mark.

Cells shall be equipped with necessary bolts and acid resisting nuts, shall be furnished with all the bolts.

Plates shall be hung suspended without touching the bottom of the containers. Containers shall provide sufficient sediment space so that the plates in the cell, as well as to avoid cleaning of cells during the expected life of the battery.

110% of the required electrolyte meeting the manufacturer’s Specification shall be supplied at the correct filling specific gravity with each battery. The Electrolyte shall be packaged in 15 gallons or less plastic coated steel drum or in plastic containers. After discharging off the specified rated capacity, the battery shall have the voltage including the internal resistance drip of all inter cell and inter rack connectors not to drop below 1.10 VPC.

The battery rack shall be few step structural steel and shall be painted with 2 coats of acid resistant grey paint. Inter rack connector terminal lugs shall be provided with each rack.

Battery shall be shipped dry with concentrated electrolyte in separate containers.

The following accessories shall be supplied with each battery set:

- Two lead plated lugs for No. 4/0 AWG copper cable.
- Two portable hydrometer syringes.
- One set of socket wrenches to fit nuts.
- Polyethylene bottle with extendable tube for topping up the battery.
- Special voltmeters to measure cell voltage.
- One gallon of anti-corrosive paint.

The following spare parts shall be supplied with each battery set:

- One positive plate
- One negative plate
- One spare container and cover
- One vent plug
- One gallon electrolyte

The battery shall be tropicalized.
All other features as stated in the table of guaranteed data schedule shall be applicable also.

DC switchboard

The distribution switchboard shall be of the cubicle type or otherwise incorporated in the cubicles for battery chargers. Double pole miniature or moulded case circuit-breakers to BS 4752 or IEC 157 shall be fitted to the DC switchboard as required by substation services, subject to the minimum requirement set out below.

The Contractor shall ensure that the DC schemes are fully discriminative and shall submit calculations and performance curves to demonstrate this.

MCCBs and MCCBs shall be fitted with auxiliary contacts which shall raise alarms on the associated bus-section or bus-coupler control panel, for the loss of supplies.

The DC switchboard shall provide individual duplicate supplies, at each voltage level for

Protection (separate supplies required where duplicate protection provided).

Control and indication

Alarm

Switchyard/switchgear.

In addition each individual transformer shall have its own DC supply for tap-changing etc.

Any additional DC supplies necessary for the specific plant design of the Contractor shall also be provided.

At least six 15A spare ways shall be provided, in addition to facilities for future circuits.

Each circuit shall be adequately labeled with its respective function.

A voltmeter shall be provided to indicate the DC system voltage on each distribution bus-bar.

5.9.4 Alarm Devices

The following shall be provided on the dc distribution switchboard:

Over voltage detection equipment of equipment on each busbar to give local indication and remote alarm when the DC voltage rises more than 5% above the normal Automatic float voltage. A time delay shall be incorporated to prevent operation when a battery with high open circuit voltage is switched form the boost to float condition.

Under voltage detection equipment on each bus-bar to give local indication and remote alarm when the system voltage falls below 80% (adjustable) of the rated system voltage. A time delay shall be incorporated to prevent initiation during temporary voltage drops caused by transient conditions including circuit-breaker closing operations.

Earth leakage detection equipment on each bus-bar to give local indication and remote alarm of the occurrence of an earth fault and to give discrimination between positive pole and negative pole earth faults. Test circuits shall be incorporated to simulate positive and negative faults by operation of test pushbuttons.

Provision of “Local Indication” by lamps on the front of the switchboard and provision for “Remote Alarm” by changeover contacts (rated at 5A for voltages between 30 and 130V AC or DC) on the devices to energizes a group alarm relay.

5.9.5 INSPECTION AND TESTING

Inspection and testing during manufacture shall be in accordance with the General conditions of the contract and as per this Specification.

The following list gives the minimum requirements to comply with this Specification.

5.9.6 Tests at Manufactures works

Battery – Routine Tests in accordance with IEC 623. Type test certificates shall also be supplied.

Battery Charger – Type and Routine Tests according to IEC. 146:1973 (BS 4417:1996).

DC Switchboard – Type and Routine Tests according to ICE 439:1973 (BS 5486:Part 1, 1977).

5.9.7 Site Tests

Insulation check of charger and switchboard with 500V megger between poles and to ground. (All diodes and electronics to be short circuited during test).

Check that all transit plugs have been removed and that each cell has been filled with the electrolyte to the correct level.

General inspection and testing of battery equipment to manufacturers instructions, including the measurement of the open circuit voltage of each cell and the specific gravity of the electrolyte.

Check the operation of the charger to prove the requirements of the Specification.

Check the operation of the earth fault detection equipment and alarms.

Carry out a full charge/discharge test on the battery, taking account of the specified duty with an 80% charged battery. Where the battery is designed for future increased load then this shall be simulated by a dummy load resistor and additional circuit breaker operations.

During the test the electrolyte temperature, cell voltage and specific gravity (where appropriate) shall be logged at regular intervals. Any cell showing significant defects, or with a voltage of more than 10% variance from the average at the end of the discharge period shall be rejected

2.

5.9.8 Design

Each battery charging equipment shall comply with the requirements of BS 4417: 1969 (IEC 146 : 1973) and shall be of the thyristor controlled automatic constant voltage type with current limit facilities and shall be suitable for supplying the normal constant load whilst at the same time maintaining the battery to which it is connected in a fully charged condition and floating across the load and charger.

Where the capacity of a charger is described as a percentage (e. g. 100%), this percentage is deemed to refer to the current of either the maximum dc load on the complete dc switchboard plus battery float charge or to the output current necessary to re-charge the 50% capacity battery to 90% of its capacity within 18 hours, whichever is the greater. The maximum dc load is that arising at any time under normal or abnormal conditions but after deduction of intermittent loads of duration less than 10 seconds. Certain other loads which only arise under emergency conditions may also be deducted from the calculated value of maximum load, subject to the agreement of the Employer.

The definitions of rated current shall apply to the continuous rated output of the charger whilst delivering power under Float conditions. The rated output under Boost conditions may equal or exceed the Float rating, but shall not be less than the Float rating in amperes.

Arrangements shall be made such that in the event of the battery becoming discharged during AC supply failure, the rate at which recharging commences is as high as possible consistent with maintaining the automatic charging constant voltage feature and with the connections remaining undisturbed as for normal service.

Each charger shall also incorporate a boost chare feature which shall, after having been started, provide an automatically controlled high charge rate sufficient to restore a fully discharged battery to the fully charged stage within the specified time without excessive gassing or any form of damaged to the battery. The boost charger shall be initiated manually. A timer shall be provided to switch the charger to the float condition after the correct recharge time.

It shall only be possible to boost charge one battery bank at a time, and the boost charger and battery shall be disconnected form the load under boost charge conditions. Full interlocking shall be provided to ensure correct d. c. system switching to avoid loss of supplies on selection of boost charging.

Each charger shall operate satisfactorily within the permitted tolerances for AC supply voltage and frequency variations. The design of the charger shall be such that it will operate satisfactorily from this supply without harm to itself, the battery or any equipment connected to DC auxiliary system.

Although it is not intended that the charger be operated with the battery disconnected, the design of the charger shall, nevertheless, be such that with the battery disconnected the charger will maintain nominal system voltage as previously specified without any damage to itself and with a ripple voltage no greater than 10% rms of the nominal output voltage.

Each charger shall also be capable of sustaining without damage to itself, a continuous permanent short circuit across its output terminals. the use of fuses, MCCBs or other similar devices will not be acceptable in meeting this requirement.

Should the AC supply fail while a battery is on boost charge the switching arrangements shall automatically revert the charger to the float charge status.

The AC input of the charger shall be fitted with a device to de-energize the charger in the event of the DC output float over voltage as described in 12.6.2.

5.9.9 Alarm Devices

Each battery charger shall be equipped with the following:

Charge fail detection equipment to give local indication and remote alarm if the voltage from the charge falls below a preset level which will be lower than the nominal float

charger voltage. Suitable blocking diodes shall be provided to prevent the battery voltage being supplied to the equipment and so prevent charge fail detection.

The device shall not operate on switching surges or transient loss of voltage due to faults on the AC system. The voltage at which the alarm operates shall be adjustable for operation over a range to be approved by the Employer.

Rectifier fuse operation detection equipment to give local indication and remote alarm of diode/ thyristor and surge circuit protection fuse operation.

Over voltage detection equipment to give local indication and remote alarm when the DC voltage rise more than 5% above the normal automatic float voltage. A time delay shall be incorporated to prevent alarm operation when a battery with high open circuit voltage is switched from the boost to float condition.

Provision or "Local indication" by lamps on the front of the charger cubicle and provision for "Remote Alarm" by changeover contacts (rated at 5A for voltages between 30 and 130 V AC or DC) on the devices to energize remote alarm relays on the associated bus-section or bus coupler control panel.

5.9.10 Instrumentation and Controls

In addition to the necessary controls for float and boost charging, the following are to be provided on the front of each charger cubicle:

Charger output / Battery Voltmeter with changeover switch/Charger DC Load Ammeter. Centre Zero Battery Charger/Discharge Ammeter with spring return switch. AC Supply MCB. A link shall be provided in the supply neutral. Float/Boost charge switch Boost Charge indicating lamp (amber).

5.10 CONTROL ALARMS PROTECTION & METERING

5.10.1 GENERAL

The substations being constructed or modified under this contract are to be designed for normal operation from a control room which is to house all the protection, control, alarm and metering equipment.

Substations are normally manned 24 hours a day and the panel layouts and arrangement should be such that all alarm enunciators are visible from the operator's desk (which is to be provided under this contract).

All panels including 1. v. a. c. and d. c. equipment located in the control room shall be of a uniform design and match in height, colour etc. The requirements for control and relay panels are as follows:

33 kV: Combined control and relay panels are required. Each circuit is to have an individual panel.

In addition separate panels are to be provided for a.c. and d.c. distribution plant etc.

A separate panel for energy metering shall be provided with two energy meters for two incoming circuits from the 2x25/41MVA transformers (to be provided by PGCB), seven energy meters for seven proposed outgoing feeders and keeping provision for extra three energy meters for future use for the spare three feeders.

Panels shall be arranged such that control panels match the sequence of plant in the switchyard.

Sufficient space shall be provided for the addition of future panels.

All 'future' or 'spare' circuits contained within the sequence of control and relay panels shall be fully equipped.

5.10.2 CONTROL PANELS

5.10.2.1 General

Circuit control panels shall contain indication and integrating meters, alarm annunciators, circuit breaker and disconnection local and supervisory control facilities check synchronizing relays where appropriate, etc.

Control panels for 33 kV circuits shall also contain the associated protection relays. Control cables shall run along the bottom of the control panels. As such panels shall have to be raised about 300mm above the floor level and accordingly the height of the control panels shall have to be reduced as practical for easy use by the operators.

All equipment mounted on the front of control panels shall be of the flush mounting type.

5.10.2.2 Mimic diagrams

Each control panel shall include a mimic diagram of the circuit (s) with which it is associated. The suite of control panels will present a continuous mimic of the switchyard layout indicating the following main items.

The bus-bar (s) and the arrangement of the circuit
Each circuit breaker, dis-connector and earth switch
Each portion of the bus-bar
Each main power and auxiliary transformer

The following colour coding shall be used for indication of voltage levels (BS 38IC Appendix 4-8 and BS 3939 refer).

Voltage kV	Colour	BS 38IC code
230	Violet	769
132	Black	-
33	Green	221
11	Red	537
0.4	Blue	166

Mimic diagrams shall contain illuminating discrepancy control switches for circuit breakers and motorized dis-connectors. Manually operated dis-connector and earth switches shall be displayed by illuminating discrepancy indicators, also included in the mimic.

Discrepancy control switches shall be of the manually operated type spring loaded such that it is necessary to push and twist the switch past its indicating position for operation. A lamp is to be incorporated in the switch base so that it will illuminate 'steady' when the circuit breaker position is in discrepancy with the control switch indication. 'Local / Supervisory' selector switches shall be provided adjacent to each discrepancy control switch.

Operation of the plant from the control panel will be subject to all interlocking procedures. The mounting height of all discrepancy switches is to be between 0.75m to 1.75m above floor level.

Each item of plant is to be identified on the mimic diagram by its plant identification number.

5.10.2.3 **Instruments and Meters**

Each circuit shall be provided with required meters and instruments.

Bus-section or bus-coupler control panel shall accommodate two voltmeters to show the voltage of the two buses and ammeter to show the transfer of power from one bus to the other. The voltmeters shall be supplied from the VT secondary winding of class 3p.

Two energy meters for the associated step-down transformers (to be provided by PGCB) and seven energy meters for seven outgoing feeders shall be installed on a separate panel. One core of each CT and VT having accuracy class of 0.2 shall be dedicated for the supply of the energy meters and the control cables shall run directly from the CTs and VTs to the energy panel.

Repeat pulse outputs are to be provided for all integrating meters.

5.10.2.4 Alarm Annunciators

Each circuit shall have an independent multi-way alarm unit, complete with its associated, accept, lamp test and reset push buttons.

Individual alarms shall be provided to give accurate information on system operation, especially following fault incidence. The compete system proposed shall be submitted to the Employer for approval prior to ordering, and shall be appropriate to the plant being supplied.

Each bus-section or coupler is to have a minimum of 4 spare ways and each circuit's annunciator a minimum of 2 spare ways for future use. Any unused ways are to be fully equipped for potential future use.

5.10.3 PROTECTION

5.10.3.1 Protection General

The general aim of the protection equipment is to isolate every fault on the power system reliably and in the minimum desirable time. All equipment must remain inoperative during transient phenomena which may arise during faults, switching or other disturbances to the system. Relays shall be of approved types complying with IEC 255, BS 142 or other internationally accepted and approved Standards.

All protection relays and associated auxiliary equipment shall be of standard construction from experienced and reliable manufacturers.

The Contractor shall submit the applicable type test certificates in accordance with IEC, BS, or other approved International Standards for all relays before they are approved. A reference list to show when and where these relays have been used before shall be submitted with the Tender Documents. This list should also state the year of commissioning.

If existing protection is required to be modified for any reason, e. g. in order to operate with newly installed equipment, the Contractor shall supply all the necessary relays, boards, wiring terminals, wiring, etc., in order to ensure satisfactory performance. This shall include the modification of the remote end (other station and / or other switchgear part) of any protected circuit. He shall also modify/improve the corresponding drawings, erect all necessary equipment and perform the commissioning in accordance with the requirements shown in these Tender Documents.

In addition to all equipment and components, the Contractor shall supply documents and calculations to prove the correct functioning of the equipment, and he shall ensure and demonstrate that the setting range of relays and the operating limits of all equipment is suitable for the intended applications.

Before approval of any item of protection, it is the responsibility of the Contractor to demonstrate that the relays, current and voltage transformers and overall protection

scheme including d.c. supply are adequately designed to ensure satisfactory protection performance under all possible system conditions.

All updating of the existing documentation with respect to modifications and extension under this contract shall be included as well as the documentation of all new installations and functions within the definite works portion of the Contract Sum.

Prices quoted shall include, whether explicitly indicated or not, all the necessary elements to co-ordinate and assure the approved and correct functioning of the protection, new or existing, in accordance with these Specifications.

Twenty percent reserve of all types of terminals used for protection shall be installed with the exception of test block terminals.

Current transformers, where possible, are to be located so as to include the associated circuit breaker within the protected zone and shall be located generally as indicated on schematic drawings.

Where additional relay equipment is to be installed in an existing Station, it is the responsibility of the Contractor for the protection equipment to ensure that the batteries and chargers have sufficient capacity to meet the additional load requirements of the new equipment. If their capacities are not sufficient he shall indicate this in his offer, and quote for reinforcement accordingly.

5.10.3.2 Arrangement of Protection Equipment

Protection equipment shall be mounted on suitable panels or racks in suitable cubicles and, unless otherwise specified, they shall be erected in the Station relay or control room. Control and relay equipment for 11 kV switchgear shall be mounted directly onto the fixed portion of the appropriate switchgear panel of cubicle.

Electro-mechanical relays shall be fitted to conventional panels, be flush mounted with rear connections and have dust and moisture proof cases to satisfy at least IP 54.

Solid state relays may be arranged for panel mounting, in which case they shall satisfy the requirements as for electro-mechanical relays. Alternatively, they may be designed in standard 19″ rack mounted modules and installed in cubicles. The cubicles shall not permit the ingress of falling water drops. Any relay contacts within the cubicles must be protected by dust proof covers.

Bus-bar protections shall be mounted on separate panels. Each bus-bar protection scheme shall be associated with separate sets of panels or cubicles.

5.10.3.3 Relays and Schemes

The components of each relay shall be suitable for operation under the local climatic conditions.

To minimize the effect of electrolysis, relay coils operating on D.C. shall be connected so that the coils are not continuously energized from the positive pole of the battery.

It should not be possible to operate manually any relay without first opening its case or cubicle door.

Each relay or relay function group of solid state elements shall have indicators to enable the identification of the faulted phases and zones of operation. Each indicator, whether of the electrical or mechanical type, shall be capable of being reset by hand without opening the relay's dust proof enclosure. Where indicated, potential free contacts shall be made available to be connected to the disturbance recorders and / or the data logging equipment.

Relay settings and indicators must be clearly visible without opening the relay's dust proof enclosure.

Tripping shall always be directly from the relevant measuring relay via carrier mounted solid links located on the front bottom section of the relay or control and relay panels. Panel mounted relays shall have trip links mounted on the front lower portion of the panel. They shall be clearly labeled. Rack mounted relays in cubicles shall have this facility clearly marked and visible at the front of the cubicle. If block-close facilities are specified, local and remote resetting shall be possible. An operations indicator shall be provided which resets when the block-close relay is reset and this relay shall be arranged to prevent the closing of any associated circuit breakers until it has been reset.

Any relay which completes the protection-initiated tripping of a circuit breaker shall have an operations indicator.

The tripping circuits of each phase of a circuit breaker shall be continuously supervised in both circuit breaker positions, where it shall be sufficient to provide a check of the trip circuit by push button and lamp, or similar device. The trip circuit supervision design shall be such that in the event of a fault in any one component it shall not be possible to trip the circuit breaker inadvertently.

The continuous trip circuit supervision relays shall initiate a delayed alarm after several seconds. This alarm shall operate for loss of tripping d. c. and for any interruption in the trip circuit wiring. Every cubicle and panel shall have at the top left-hand corner one easily visible lamp to indicate that a circuit in the cubicle or panel has initiated an alarm. On the Station alarm panel an alarm shall be given which can only be reset manually at the panel or cubicle. The purpose of this is to ensure that operations personnel locate the correct cubicle or panel for recording relay indications and resetting them.

Where two groups of relays are used to protect a circuit, the VT circuits and the d.c. supplies shall be arranged so that one group may be switched out without affecting the performance of the other group.

Any interruption of the d.c. supply to relays shall initiate an alarm. Converters and inverters used for feeding relays shall have their outputs monitored and shall initiate an alarm in the event they fail. These devices shall be of short circuit proof design.

Relay terminal arrangements shall be to the approval of the Engineer. Snap-on type terminations will not be accepted.

Relay contacts shall be suitable for making and breaking the maximum currents which they may be required to control in normal service but where contacts of the protective relays are unable to deal directly with the tripping currents, approved auxiliary contactors, relays or auxiliary switches shall be provided. In such cases, the number of auxiliary contactors or tripping relays operating in series shall be kept to a minimum. Specified operating times shall be met with auxiliary relays included.

Separate contacts shall be provided for alarm and tripping functions. Relay contacts shall make firmly without bounce and the whole of the relay mechanisms shall be as far as possible unaffected by vibration or external magnetic fields.

Relays which rely for their operation on an external D.C. supply shall utilize for this purpose the trip supply of the associated circuit-breaker. This supply shall be monitored and an alarm provided in event of failure.

All possible precaution shall be taken to ensure that direct current operated relays which performer a tripping function are not liable to mal-operation. For this reason the following measures shall be taken:

The total capacitance to earth of all connections to the negative pole of the tripping battery shall not exceed 10 microfarad.

If the positive side of a relay coil is connected to wiring external to the relay cubicle then the relay shall not operate if a capacitor of 10 microfarad charged to 110% of rated voltage is discharged through the relay.

The current at operation shall be greater than 100 milliamps.

The maximum a. c. fault voltage across any two points of a current circuit shall not exceed 3000 volt peak and non-linear resistors shall be included if necessary to achieve this limitation. The D.C. operating range of the relays shall be co-ordinated with the battery/charger design.

Panel mounted individual relays shall have labels fitted beneath them which clearly indicate the relay function and which also refer to the standard nomenclature used by the supplier in the relevant Station as-built drawings.

Rack mounted, solid state relays erected in cubicles shall have each complete relay function-group of elements labeled in a similar manner to the labels for individual relays.

Relay settings for all unit type protective schemes and for distance relays, directional earth fault relays, power swing blocking relays etc. shall be submitted by the Contractor to the Employer for approval 3 months prior to commissioning of any plant. Settings shall also be provided for those relays and other equipment provided under this Section of the Contract which do not require an intimate knowledge of existing relay settings, e. g. circuit-breaker fail relays.

The Contractor shall provide electrical protection relay schedules to include manufacturer, type, designation, characteristic details and ranges and actual protection settings to be used, on a per circuit basis.

5.10.3.4 Testing of Relays

It shall be possible to test the setting and function of any a. c. actuated relays by secondary injection without disconnecting any wire or permanent connection. These tests shall be carried out by injecting directly into the individual relay or into a specially provided test block. The test block shall be subject to approval by the Engineer.

Injection sockets shall be arranged so that it is not possible to open circuit current transformer secondary when inserting test plugs. The trip functions, if not interrupted by a test switch, shall be blocked when inserting the test plugs.

Where separate test blocks are used, incoming voltage, current and d. c. circuits shall be connected to the bottom of the block and connections to the relays shall be at the top. Four plugs for each type of test block used shall be supplied per Station.

When Separately mounted interposing current transformers are used, there shall be means to measure the secondary current of the main CTs and also to measure the interposing CT's secondary currents, at the relay, or by other testing blocks. All such testing facilities shall be clearly labeled.

5.10.3.5 Individual 33 kV Protection Schemes

5.10.3.5.1 33 kV Overhead Line Protection

General

In general the protection shall be designed in accordance with the following paragraphs. However, the Contractor shall ensure that the protection supplied can perform satisfactorily with that supplied at the remote terminal.

The 33 kV bus coupler and the over head line protection shall be designed for over current and earth fault protection in accordance with diagram attached and the following:

(a) Over current and Earth Fault Relays

Two single-phase normal IDMT relays shall be provided for over current protection. These relays shall comply with BS 142 : 1966 and their curves shall be such as to give

tripping after three seconds for ten times the current setting when a time multiplier setting of 100% is applied.

The over current relays shall have current ranges from at least 50% to 200% in steps of 25%.

The earth fault relays shall have current ranges from at least 20% to 80% in steps of 10%.

The time settings for both over current and earth fault relays shall be continuously variable from 0 to 1.0 or, as an alternative, with steps of at least 0.025 from 0.05 to 1.0.

5.11 EARTHING SYSTEMS AND LIGHTNING PROTECTION

5.11.1 GENERAL

All earthing system generally in accordance with the requirements of IEEE 80 and BS 7430 shall be designed under this Contract. The earthing system shall include earth electrodes to provide the connection to the general body of the earth, all earthing conductors 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 difference on the site and adjacent to the site to ensure safety to people and animals.

Protection for all electrical equipment against lightning shall also be provided.

5.11.1.1 Extent of work

The Work under this Section comprises the design, supply and installation including excavation, backfilling and site testing of earthing systems and connections to electrical apparatus at each substation. Also included is the lightning protection scheme and the provision of portable earthing devices.

The Contractor shall be required to undertake all necessary earth resistively tests at the substation sites and from these tests, to undertake the design of the earthing systems. These designs 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 this specification.

The design calculations of steps 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.

The Power Grid Company of Bangladesh, designed and constructed the 132kV sub-station at FENI and installed the earthing system. The contractor under this present

contract shall consider the design of 132kV sub-station while designing the earthing system of 33kV switching station.

5.11.1.2 Soil Survey

The preliminary Bid design shall be based on a value of 100 ohm-m.soil resistivity. Not later than one month after the site has been handed over for access, the Contractor shall carry out an earth resistivity survey of the sites and report in writing to the Employer in accordance with the approved program. The report shall detail the methods and instruments used and the results of the surveys. Based on the results the Contractor shall include in the report his proposals 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 undertaking rock, which may limit the depth for driving earth rods or boring will be necessary for installing earth rods.

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

The report should also state if there are any indications that the ground is corrosive to bare copper.

The report shall be approved by the Employer before proceeding with the design of the earthing system.

5.11.1.3 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 one second. The preliminary earthing design shall be such that the potential rise shall not exceed 5 kV.

5.11.2 EARTH ELECTRODE SYSTEM DESIGN

5.11.2.1 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 shall be to the approval of the Employer and shall be based on the methods given in the standards listed. The calculations shall include the following parameters:-

(a) Earth resistance of the whole system and of its components
(b) Earth potential rise
(c) Step touch and mesh potentials inside and outside the perimeter fence
(d) Requirements for a high resistance surface layer
(e) Conductor ratings

Earthing points shall be provided such that the combined resistance of the earth grid and all other earthing points does not exceed 0.5 ohm during the dry season.

Earthing points rises shall not exceed the CCITT 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.

5.11.2.2 Earth Electrode

The earth electrode shall comprise a system of bare 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.

5.11.2.3 Mesh System

The mesh system shall be designed to limit touch, step and mesh potentials taking into account the combined length of the mesh conductors, other buried conductors and rods but excluding any buried conductors outside the perimeter fence. Due regard shall be given to non-linear distribution of the fault current giving rise to the highest potentials at mesh comers.

The rating of the mesh conductors shall be compatible with the fault cur-rents after allowing for parallel paths of hard drawn high conductivity copper strip with a minimum conductor size of 150mm^2.

The conductor shall be installed in trenches excavated by the Contractor to a depth of 500mm. The system will be installed after all foundations have been laid and the site filled to 100mm below finished level. When the earthing grid has been laid and backfilled, bricks will be laid up to finished site level. Where the excavated material is rocky or may be difficult to consolidate, the backfilling 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.

5.11.2.4 Earthing Rods

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

Rods shall be installed inside the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. (The spacing between rods shall not be less than their length, unless rating considerations determine otherwise). The copper rod electrodes of 15mm diameter shall be interconnected in groups of four to eight rods by insulated copper conductors and non-ferrous clamps to form a ring. Each group shall be connected to the mesh by duplicate insulated copper conductor via disconnecting test links.

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

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 nt be less than of the group of rods with a minimum conductor size of $70mm^2$.

The calculation of potentials in the design of the complete installation shall be made without the group of rods with the lowest estimated resistance to simulate the condition with the group disconnected for testing:-

5.11.2.5 Other Conductors

As an alternative to rods to supplement a mesh, additional bare copper conductors with a cross-section area of not less than $150mm^2$ may be used. They shall be buried in the ground within the perimeter fence to enclose the maximum possible area compatible with the earthing of any metallic fence. Such conductors may be laid below the mesh, below foundations or in areas where there is not 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.

5.11.2.6 Reinforcing Steel

The reinforcing steel in the foundations of buildings containing the primary electrical equipment may be used as auxiliary electrodes, subject to the approval of the Engineer. The Contractor shall show in the design calculations that the fault currents and d.c. stray currents will not damage the structure

5.11.2.7 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 limits.

The minimum conductor size shall be 75mm^2 copper and shall be connected to the fence or the mesh with 75mm^2 conductors at each comer of the site and at intervals of not more than 100m. These conductors shall not be included in the calculations called for above.

5.11.3 DESIGN OF EARTHING SYSTEM

5.11.3.1 Earthing System

An earthing system shall comprise the following components:-

(a) The conductors between the earthing electrode and the main earthing bar
(b) The main earth bar
(c) The conductors between the main earth bar and the metallic frames, enclosures or supports of electrical equipment

(d) The conductors between structural metalwork and non-electrical equipment and the main earth bar.

The rating of earth system conductors connected between and 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 of earth system shall into account the corrosiveness of the soil based on the soil survey.

The design comprising all the above-mentioned items shall be submitted to the Employer or approval within four months of the award of Contract.

5.11.3.2 Connection of System Neutrals and Earth

The system neutral points within a substation shall have duplicate connections to the closest earthing point.

The earth electrodes of a neutral earthing point shall be arranged in two groups with a conductor from each group to a test link and there shall be duplicate bare copper conductors of cross sectional area not less than 150mm^2 from each test link to the earth grid. The duplicate connection may be in the form of a ring.

5.11.3.3 Main Earthing Bar

The main earthing bar shall be in the form of a ring or rings of bare conductors surrounding of within an area in which items to be earthed are located. Where two or more rings are installed they shall be interconnected by a least two conductors which shall be widely separated.
The main earthing bar or parts thereof may also form part of the earth electrode system providing this is bare conductor.

Each main earthing bar shall be connected by a least two widely separated conductors to the earth electrode system.

The minimum conductor size for the main earth and interconnections between earthing bars and the earth electrode system shall not be less than 150mm^2.

5.11.3.4 Electrical Equipment 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 150mm^2.

All substation equipment, including dis-connectors, earthing switches, main transformer tanks current and voltage transformer tanks, switchgear, electrical supporting steelwork and gantries etc. shall all be connected with the earth grid.

Surge arresters installed for the protection of transformers and reactors shall be connected by low reactance paths both to the transformer tanks and to the earthing system.

Capacitor voltage transformers used in connection with line traps shall be connected by direct low reactance paths to a single earth rod for each arrester, in addition to the earth grid.

Where necessary an earthing mat shall be installed at all operating positions for outdoor HV equipment manual operating mechanism boxes and local electrical control cubicles to ensure the safety of the operator. The mat shall be directly bonded to the cubicle and the conductors forming the mat and the bonding connection shall have a minimum copper cross-section area of 75mm^2.

Galvanized structures comprising bolted lattice components shall not be used as the sole earth connection path to post and strain insulators or to overhead line earth conductors.

Buildings containing electrical equipment shall be provided, at each level, with a ring of earthing conductors which shall have duplicate connections to the earth grid outside the

building. The frames of all switchgear, control and relay panels and other electrical equipment and exposed structural metal work shall be connected by branches to a ring. The ring and branch conductors shall be of the same material as the earth grid. Strip run within buildings, inside cable trenches or above ground level on apparatus shall be neatly supported in non-ferrous clamps.

Fixed earthing connectors for use with portable earthing devices specified below shall be provided on each bus-bar and on both sides of high voltage equipment.

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.

5.11.3.5 Connections to Non-Electrical Structural Metalwork and Equipment

All metalwork within the project area which does not form part of the electrical equipment shall be bounded to the main earth bar except where otherwise specified. The bonding conductor for size shall be not less than 150mm^2.

Individual components isolated metallic components mounted on non-conducting building fabric need not be bonded to the main earth bar.

5.11.4 MATERIALS AND INSTALLATION

5.11.4.1 Earthing Conductors

Conductors shall be of high conductivity copper in the form of circular conductors standard to IEC 228 (BS 6360) or solid rods or bars to BS 1433.

Conductors buried in the ground shall normally be laid at a depth of 500 mm in an excavated trench. The backfill in the vicinity of the conductor shall be free of stones and the whole backfill shall be well consolidated: Earthing 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.

5.11.4.2 Earthing 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 ensure the minimum of distribution to the rod. Where it is not possible to drive rods to the full depth required due to the presence of a strata of rock then holes shall be drilled or blasted in the rock. The holes shall be filled with betonies or other approved material prior to inserting the rod. If difficult driving conditions arising from hard or rocky ground are encountered or the 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 minimum radial thickness of not less than 0.25 mm. The overall diameter shall be not less than 12mm. Rolled external screw threads shall be used on the rods for coupling and after rolling the thickness of the copper coating on the threaded portion shall be not less than 0.05mm.

Rods, driving caps and tips shall about at couplings to ensure that the couplings and screw threads are not subject to driving forces. All screw threads shall be fully shrouded at the coupling. Alternatively, conical couplings may be used to the approval of the Employer.

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 C101 of C102) for copper earth rods and to ISO 1337 Grade Cu-ETP (BS 28734 Grade C101) for the molecular bonded copper coating of steel rods.

The steel for copper-clad steel rods shall be low carbon steel with a tensile strength of not less than 570 N/mm^2 to ISO 630, Grade FC 430A (BS 4360, Grade 43A) or better.

Couplings for copper rods shall be of 5% phosphor bronze (copper-in-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 10-1 and BS 2871, Grade CA 102.

5.11.4.3 Fittings

Clips for 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 the 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 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 concrete base.

Disconnecting links mounted at ground level and the connections at the earth rods shall be enclosed in concrete inspection pts, 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 immaterial 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.

5.11.4.4 **Joints**

Permanent joints shall be made by exothermic welding below ground or crimping for above ground connections.

Detachable joints shall be bolted and stranded at bolted joints shall be terminated in exothermically welded lugs or a crimped cable socket. The diameter of any holes drilled in strip conductors shall not be greater than half the width of the strip.

Connectors to electrical equipment shall be detachable and made at the earthing points of 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 Employer.

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 Employer.

Bolted joints in metallic structures, including pipe work and which do not provide direct metallic contact, shall either be bridged by a bounding conductor or both sides of the joint shall be separately bonded to earth, unless the joint is intended to be an insulated joint for cathodes 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 fittings 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.

5.11.5 LIGHTNING PROTECTION

Overhead earthwire shall be provided to project the equipment from direct lightning strikes. The screens shall be of aluminum class steel wires of not less than 50mm total section, and connected to provide low impedance paths to earth.

The layout of the earth wires shall be such that equipment to be protected generally lies within areas bounded by two or more conductors, in which case the protected angle shall not exceed 45'. Where equipment is protected by a single earth wire, the protective angle shall not exceed 35' to the vertical.

The overhead earthwire shall be suitable for extension to protect the substation equipment to be installed in future stages of development.

5.11.6 EARTHING OF FENCES

5.11.6.1 Method

Metallic fences shall be separately earthed unless they come within 1.8mm of my equipment or 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.

5.11.6.2 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 the fence posts shall be connected to the centre 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 comer 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.

5.11.6.3 Bonded Fences

Fences which need to be bonded at 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 1.8m 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.

5.11.6.4 Bonding of Fence Component

Fences made up of bolted steel or other metallic components do not require bonding between components. Where such fences have non-metallic components, bonds 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 components, or for anti-climbing guards and the wires of chain link shall be directly bonded t each fence earth electrode or to each bond to the main earthing system.

Metallic components on masonry, brick concrete or similar boundary wall shall be treated in the same manner as metallic fences.

Wire fence components coated for anti-corrosion protection shall be earthed in accordance with this Clause.

5.11.6.5 **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.

5.11.6.6 Potential Control Outside Fences

Where the approved design calculations show that the touch or step potentials outside the fence or boundary wall would otherwise be excessive, bare copper conductors shall be buried in the ground outside the fence or boundary wall at such depths and spacings as are shown in the approved design calculations to give acceptable touch and step potentials. The conductors shall form complete rings surrounding the installation and each ring shall be bonded to the adjacent ring and to the fence at each comer, below the outer phase conductors of overhead line connections passing over the fence at each gate and at intervals of not more than 100m. 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 bounded to the main earth system at each comer 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 1.8m of any part of the main earthing system of equipment bonded thereto, the fence and outer conductor rings shall not be connected to the main earthing system unless the approved design calculations show otherwise.

Any meshes formed by bonding the outer conductors to the main earthing system shall be sub-divided by additional conductors, if required, to give acceptable touch step and mesh potentials.

5.11.6.7 Conductors

If conductors used for earthing and bonding the fences and components and for outer rings shall have cross-sectional area of not less than $70mm^2$.

Connections shall be made of copper strip of 30mmx5mm cross section between the overhead earthed screen wire and the main substation earthing system at each support unless the galvanized steel support structure has sufficient area and current carrying capacity.

Earth wires shall be held in clamps with free pin type joints between clamp and supports.

Connections shall be provided for the terminations of the earth wires of he overhead lines. Including bimetal connectors where necessary.

The design of all structures shall generally comply with the specification and in addition is to ensure that in the event of breakage of one earth wire, the Factor of Safety is not less than 1.5.

5.11.7 PORTABLE EARTHING DEVICES

Portable earthing devices for use with outdoor 33kV apparatus in substitutes shall be supplied 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 busbar end clamp to suit the connectors of the type supplied under the Contract.

(c) Flexible stranded aluminum alloy conductor with clear protective PVC sheath, sized 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.

5.12 SUPPORTING STRUCTURES FOR OUTDOOR EQUIPMENT

5.12.1 SCOPE

Where specified structures shall be provided for supporting the conductors, busbars, insulators, isolating switches, circuit breakers, current and voltage transformers, surge arresters, and other items of plant generally as shown on the relevant drawings. Facilities shall also be provided where specified for the termination of the outgoing 33kV distribution lines.

All structure designs shall be such as to facilitate inspection, painting, maintenance, repairs and operation with the continuity of supply being the prime consideration.

The arrangement of the high level structures supporting conductors and/or busbars shall be either lattice structures primarily composed of angle sections or low visual impact a frame type structures primarily composed of welded hollow or composite sections. angle, hollow or composite sections shall be either steel or aluminum as specified. For lattice structures a fully triangulated system of bracings shall preferably be adopted. For A-frame structures the primary functions between major components shall be bolted, for ease of transportation and erection.

Low level support structures shall be either lattice structures, primarily composed of angle sections or 'moment' type structures primarily composed of welded hollow or composite sections.

The design and arrangement of supporting structures shall be subject to approval by the Employer.

The type of arrangement of high level structures and acceptable materials for both high and low level structures shall be as specified in the Schedule of Technical Requirements.

5.12.2 DESIGN

5.12.2.1 General

The supporting structures shall be designed to ensure that the specified minimum phase, earth and section clearances are maintained under all conditions. Where applicable special attention shall be paid to the design of the line termination structures to ensure minimum phase clearance is obtained for the complete range of angles of entry specified.

The strength and rigidity of structures shall be such that the alignment of the equipment which they carry shall not be affected by the static and dynamic loads to which the structure are subject.

The assumptions made in the overall structural design especially in the load transfer between the gantry beam and column shall be adequately reflected in the design and detailing of the beam column connection.

5.12.2.2 **Assumed Loading Combinations**

The supporting structures shall be designed to resist the ultimate applied loading determined is accordance with the following load combinations:

Load Combination 1-Design Wind, Coincident Temperature, (Ice)B

(a) The wind pressure specified in the Schedule of Technical Requirements Appendix-11 of this Section applied to the projected area of all conductors and electrical equipment.

(b) The wind pressure specified in the Schedule of Technical Requirements applied to the projected area of all members of the windward face of structure:

(c) Where appropriate the conductor and/or earthwire tensions or busbar forces including due allowance for both horizontal and vertical deviations/inclinations:

(d) Self weight of the equipment and structure:

(e) When stated in the Schedule of Technical Requirements the effects of the specified radal ice thickness shall be taken into account in the determination of the wind area the conductor, earthwire busbar, electrical equipment and the supporting structure, the conductor and earthwire tensions and the self weight of the equipment and the structure.

The wind directions considered shall include transverse, longitudinal and if appropriate 45’ to the major axis of the structure.

Load Combination 2-Still Air, Short Circuit, Minimum Temperature or Maximum Operating Temperature.

(a) Conductor and/or earthwire tensions or busbar forces including the dynamic affects calculated in accordance with IEC 865-1.

(b) Self weight of the equipment and structure:

Unless agreed to the contrary, the “resultant spring constant”(s) of both supports of one span for strained conductors shall be taken as 10’ N/m for steel structures.

Load Combination 3-Still Air, Seismic, Coincident Temperature (Ice)

(a) Conductor and/or earthwire tensions or busbar forces:
(b) Seismic forces;
(c) Self weight of the equipment and structure;
(d) When stated in the Schedule of Requirements the effects of the specified radial ice thickness.

Seismic forces shall be applied as a static horizontal force transversely and alternatively longitudinally to the major axis of the structure and shall be equal in value to the seismic coefficient stated in the Schedule of technical Particulars multi-piled by the self weight of the conductor, earth wire, bus-bar, electrical equipment and structure, and applied at the centre of gravity of the equipment and structure as appropriate.

Load Combination 4-Still Air, Erection, Coincident Temperature

(a) Conductor and/or earth wire tensions or bus-bar forces;
(b) Self weight of the equipment and structure

For erection conditions any one complete phase conductor bundle or bus-bar or earth wire shall be assumed not to be erected in any one span.

For the purposes of design all high level structures shall be considered as terminal structures. For multi-bay continuous structures, central columns shall be designed for the most onerous variation f adjacent bays being loaded or unloaded.

5.12.2.3 Line Termination Structures

For details of the incoming transmission line phase conductor and earth wire details and angles of entry reference should be made to the Schedule of technical Requirements.

5.12.2.4 Partial Load Factors

The partial load factors to be applied to the loading combinations determined in accordance with Clause 11.3.2 shall be as specified in the Schedule of Technical Requirements.

5.12.2.5 Wind Loading

The reference wind pressure to be adopted for the design of the outdoor supporting structures shall be based upon the value specified in the Schedule of Technical Requirements. The reference wind pressure at a height of 10m above ground level shall be subjected to variation for height and shape of the structure or equipment under consideration to give the total wind load.

5.12.2.6 Equipment and Conductor Terminations

All supporting structures shall be provided with such holes, holts and fittings as may be necessary to accommodate insulators, isolating switches and other equipment provided under the Contract.

Where incoming transmission lines and/or conductors and/or earth wires are terminated at structures with tension sets, approved shackle or swivel attachments shall be provided. To facilitate maintenance and erection, additional attachment points shall be provided

adjacent to the main termination attachment. The supply and connection of the incoming transmission line will be undertaken under a separate contract.

Structures required to support cable sealing ends shall be provided with arrangement for supporting the cables. Attachment holes for the connection of earth wire bonds shall be provided adjacent to the earth wire attachment point. Attachment holes for the connection of the substation earthing grid shall be provided on the vertical face of the structure, approximately 300mm above the top of concrete. Foundation holding down bolts shall not be used for the attachment of earth connections.

5.12.2.6 To facilitate safe inspection and maintenance all supporting structures which cannot be maintained from ground level shall be provided with climbing facilities, inter-circuit screens, guards etc. in appropriate positions as agreed with the Employer.

5.12.2.7 All members indicated at 40° or less to the horizontal, shall be designed to resist a mid-point load of 1.5kN. with not other loading being considered.

Where specified step bolts of an approved type shall be fitted to supporting structures at not more than 450mm centers starting as near as practicable to the base and continuing to within 1m below the top of the structure. It shall be noted on the erection drawings that all step bolts are to be removed after construction for a distance of 2.0m above ground level. Adequate clearance shall be provided between the step bolts and any obstructions which might interfere with their use. Step bolts shall not be less than 16mm diameter, project not than 150mm and be fixed with nut washer and nut.

Where specified ladders of an approved type generally in accordance with the requirements of BS4211 450mm wide and 350mm rung spacing shall be fitted to supporting structures. They shall be incorporated into the structure either integrally or separately. Where specified cable protection or fault arrest systems shall be fitted to the ladder. Means shall be provided to prevent unauthorized access of ladders.

Inter circuit screens shall be provided where necessary to prevent access between adjacent circuits on multi-bay structures. Inter-circuit screens shall be fabricated from a 50mm x 50mm mesh formed from 3mm diameter galvanized steel wire.

All structures shall be fitted with identification/notice plates as appropriate.

5.12.2.8 <u>Structural Design</u>

The allowable ultimate unit stresses used in the determination of the nominal member's dimensions of supporting structures shall be based on the following:

Lattice structures	ANSVASCE 10-90
Steel A frame or moment structures	BS 5950
Aluminum structures	BS 8118: Part 1

Partial factors to be applied to member nominal strength determined in accordance with the above stated codes shall be as specified in the Schedule of technical Requirements. For ANSI/ASCE 10-90 the appropriate reference stress levels shall be based on the values specified in BS 5950.

The maximum allowable slenderness ratios shall not exceed the following:

	Steel Aluminum
For column or support leg members, beam chords	120 mm
For other load bearing; compression members	200 mm
For secondary (redundant bracings)	250 mm
For tension only members	350 mm
Minimum Size of Member	45x45x5 mm

Members shall be of such shape, size and length to preclude damage or failure from vibration or stress reversal, including the detailing of connections.
Minimum member thickness and diameter of bolts shall be as specified in the Schedule of technical Requirements.

Holding down bolts shall be used to connect the structures to their foundations. The design of holding down bolts shall make adequate provisions for combined axial and shear forces.

The nuts of all bolts attaching conductors busbars or earthwire tension sets etc. shall be looked with a locknut. No screwed threads shall form part of a shearing plane between members and bolts shall not project more than 10mm beyond the nut.

5.12.2.9 Design Submissions

The Contractor shall submit all design calculations drawings and method statements as required. All sets of calculations shall be complete, bound, properly titled and given a unique drawing number. An agreed system of identification of the structure design reference fabrication drawings and substation general arrangement drawings shall be sued.

Calculations shall contain a Design Information sheet, derivation of all applied loading including sag and tension and dynamic tension calculations, the design load for each members group under the critical loading case, member size, slenderness ratio, allowable laod end connection detail and foundation load schedule. Codes or standard references should be quoted and where computer programs are used a full explanation in the English language shall be provided to assist the Engineer's approval of the calculation.

5.13 MATERIALS

All steel shall comply with BS EN 10025 or BS EN 10210 as appropriate and shall be suitable for all usual fabrication process including hot and cold working within the specified ranges. The Contractor must take due cognizance of the minimum ambient temperature quality of steel charpoy impact value and stress relieving.
The quality of finished steel shall be in accordance with BS EN 10163. All shall be free from blisters, scale, lamination, segregation's and other defects. There shall be no rolling laps at toes of angles or rolled in mill scale.

Hot rolled steel plate 3mm thick or above shall be in accordance with the requirements of BS EN 10029.

Bolts and nuts shall be ISO Metric Black Hexagon to BS 4190 and shall be threaded ISO Metric Course Pitch to BS 3643: Part w. Tolerance Class 7H/8g. Only one grade of steel

shall be sued per bolt diameter. Washers shall be in accordance with BS 4320 Grade E and BS 4464 Type B as appropriate.

Consumables used in metal are welding shall be in accordance with the relevant standard.

All materials for aluminum structures shall be in accordance with BS 8118: Part2.

5.14 WORKMANSHIP

The Contractor shall submit panel assembly (fabrication) drawings which shall show all materials in place, complete with all fabrication and connection details. A complete tabulaiton listing all pieces, bolts, nuts, washers etc. shall also be shown on the drawings. The Contractor shall make changes to the fabrication details which the Engineer determines necessary to make the finished structure conform to the requirements and intent of the specification.

The Contractor shall submit a detailed method Statement of proposed fabrication procedures including quality control procedures to ensure satisfactory assembly and erection, interchangeability of similar members, accuracy of dimensions, position and alignment of holes.
All welding shall be carried in accordance with BS 5135 for steel structures and BS 8118 part 2 for aluminum structures. All members shall be stamped on before galvanizing or other protective coatings, using characters 10mm high and shall be clearly legible after galvanizing.

5.15 PROTECTIVE TREATMENT

Unless otherwise specified after fabrication all structural steelwork, including bolts, nuts and washers shall be hot dipped galvanized to meet the requirements of BS 729. Bolt threads shall be cleaned of surplus spolter by spinning or brushing. Dices shall not be used for cleaning threads other than on nuts. Nuts shall be galvanized and tapped 0.4mm oversize and threads shall be oiled.

Excessively thick or brittle coatings due to high levels of silicon or phosphorous in steci, which may result in an increased risk of coating damage and/or other features that make the final product non-fit for purpose shall be cause for rejection. Protective treatment for aluminum shall be in accordance with the requirements of BS 8118.

Galvanizing thickness and aluminum protection procedure shall be as specified in the Schedule of Technical Requirements.

5.16 QUALITY CONTROL

5.16.1 General

Routine tests of raw materials and fabricated individual members shall be undertaken in accordance with EN 10025.1 EN 10210 and BS 8118 as a appropriate.

All steel ex-mills or received from merchants stock shall be marked to identify the cast or casts from which it was rolled in accordance with Section 9 of BS EN 10025 and Section 10 of BS 102.10, and shall covered by the appropriate (mill) certificate. The optional impact test BS EN 10210 option 1.6 for quality JO is required.

The material grades or alloy categories of individual pieces of steel aluminum shall be capable of positive identification at all stage of the fabrication process.

Bolts and nuts shall be covered by the appropriate test certificate prove compliance with BS 4190.

5.16.2 Welding

Unless specified to the contrary all structural welds shall be undertaken using approved welding procedures in accordance with BS EN 288. All welders shall be breasted to the requirements of BS EN 287.

All welding shall be subject to a non-destructive testing (NDT) program, which shall include visual, ultrasonic and magnetic particle testing as appropriated. Visual inspection shall be in accordance with BS 5289, ultrasonic to BS 3923 and magnetic article to BS 6072. Accordance criteria shall be in accordance with BS 5135, except for porosity and BS 8118: part 2. All welds specially but welds must be continuous to ensure a pickle-tight connection when galvanized.

The Contractor's NDT program shall be submitted to the Engineer for approval prior to the commencement of fabrication.

5.16.3 Check Erection

Prototype structures shall be check erected in order to verify the accuracy of detailing and fabrication.

The degree of check erection shall be sufficient to verify not only the main structure but all auxiliary steelwork. Sufficient blocking and support shall be provided to prevent distortion and overstressing of members to ensure proper fit. Assembly shall be accomplished without extraordinary effort to align bolt holes or to force pieces into position. Bolt holes shall not be reamed or enlarged. Any damage to protective coatings during check erection if the check erection is undertaken on coated structures shall be recoated at the fabricator's cost.

5.16.4 Galvanizing

Test on galvanized members and components shall be carried out at the works to ensure compliance with the requirements of BS 729.

5.16.5 Tolerances

The fabrication tolerances after galvanizing for steel members which are not to be considered cumulative shall be as follows:

On linear dimensions of nominal sections as per BS 4, BS 4848, BS EN 10024, BS EN 10034 & BS EN 1056-2.

(b) On overall length of member --- ± 1 mm

(c) On centers of holes --- ± 1 mm

(d) On groups of holes --- ± 2 mm

(e) On back-gauges --- ± 1 mm

(f) On corresponding holes in opposite faces of a member --- ± 1 mm

(g) On specified hole diameter on the punch side (in the black), or when drilled --- ± 0.3 mm

(h) Taper on the punched holes as measured between the specified hole diameter on the punch side and the hole diameter on the die's side (in the black) --- ± 1 mm

(i) On specified tends open and closed flanges --- ± 0.02 mm

Tolerances for aluminum structures shall be in accordance with BS 8118: Part-2.

5.16.6 ERECTION

The Contractor shall when requested provide the Engineer with a Method Statement detailing his proposed erection methods. Due cognizance shall be taken of the relevant parts of BS 5531 and current health and safety legislation.

All structural members stored on site shall be kept clear of the ground where possible. Contact with substances likely to attack the protective coating shall be avoided and all members kept in a clear and tidy condition. Care shall be taken to prevent damage/deterioration of any protective coating during transportation, storage and erection.

The Contractor shall ensure that the structure are not strained or damaged in any way during erection. Structures shall be erected vertically within a tolerance at the top, or the centre of the beam of 0.5% of the overall structure height before equipment installation or conductor/bus-bar stringing.

5.17. CIVIL AND BUILDING WORKS

5.17.1 General

The section covers all earth work, pilling work, foundations and buildings associated with the project together with roads, surfacing, cable trenches and tunnels, fencings, guard houses, foul and storm drainage and water supply.

The work includes the design, detailing, construction and maintenance of the following:

(i) foundation for all equipment to be installed in outdoor switchyard, indoor panels and Control room building (3 storied) and any other buildings, required for the project.

(ii) roadways generally within sites, surfacing the entire area within site boundary and surface water drainage.

cable trenches, cable tunnels, cable ducts and pipe ducts

modifications and extensions to existing buildings, structures, boundary walls, roads and all other construction to accommodate new equipment, if any.

Plus the detailing, construction and maintenance of the following items which shall generally be constructed to BREB standards but full working drawings shall be prepared by the Contractor:

guard house,

boundary wall and entrance gate and]

internal road

Plan, design and drawings of the above items shall be submitted to the Employer for approval.

If non standard walls may be required to match existing walls in which case the Contractor shall prepare full working designs for these items to design briefs agreed on site, and build the walls at no extra cost. A brief description of all works shall be agreed by the Contractor on site.

5.17.1.1 Contractor to satisfy himself as to all conditions

The Contractor shall assess:
access conditions at all sites, plus ground conditions and ground bearing capacity.
transport costs, materials costs and restrictions of availability of supply of materials locally.

importation restrictions and delay due to customs controls
restrictions imposed by existing equipment on sequence of construction, access etc.

restrictions caused by cable laying and overhead line contractors

ground conditions and temporary works required to provide support during excavation.

5.17.1.2 Way leaves, Land purchase and Planning permission

The Employer shall be responsible for the purchase of all land within the permanent site boundary and the purchase of all land required to the base of the fill of any batter slopes. The Employer shall also be responsible for access to the site from the nearby road. During the construction period the Contractor shall be responsible for maintaining this access in a reasonable condition by reinstating damage caused by his construction traffic and Employer traffic.

5.17.1.3 Site Survey drawings

The Contractor shall prepare a drawing at 1:200 scale showing existing ground levels on a minimum 5 meter grid and details of all features above and below the ground within the site boundary. The Contractor shall propose the switchyard ground level to the Employer, which shall match the level of FENI 132/33kV sub-station switchyard of PGCB.

5.17.1.4 Earth Works

Fill where required will be placed by the Contractor. The Contractor shall be deemed to have included in the Contract sum for providing a level or uniform level site to suit his sub-station layout design. The final soil levels shall be stated on the site survey plan.

All fill shall be compacted in layers not exceeding 150 mm deep to a minimum of 90% optimum density as defined by the Proctor Test.

Any surplus materials shall become the property of the Contractor and may be sold. All imported fill shall be sand or sandy silt with clay content less than 55.

5.17.1.5 Employers' Accommodation/Surveying Equipment.

The Contractor shall provide 6 desk, 12 chairs, 6 fan for the sole use of the Employer and his inspectors. The Contractor shall also provide 3-split type air conditioners to be installed in the control room and the office room.

The Contractor shall loan his surveying instruments to the Employer and his staff when required. Instrument checks shall be carried out at monthly intervals.

5.17.1.6 Program

The Contractor's program shall define the following key dates for each site, where drawing are to be submitted for approval they shall be submitted at least 6 weeks before the key dates to allow for the Employer to comment and his comments to be incorporated in the drawings:

Issue of approved site survey drawing complete with soil levels

Issue of approved electrical layout drawings

Completion of Site Investigation field work

Issue of approved Site Investigation Final report

Completion of loading tests on a foundation on each fill site and any other site where settlement is likely to be a problem.

Issue of approved drawings required for Planning Permission

Issue of a full complete set of civil building drawings

Construction start date

Date access will be given for:

Installation of equipment in Control Buildings

Installation of outdoor plant

Construction finish date

The drawing program shall ensure a complete set of approved foundation drawings is issued at least 21 days before construction start at the site.

The Construction program shall be expressed in an 'S' curve for the whole project, with the percentage (of total value of work in the schedules) given for the site each month. The overall percentage completion of the project each month shall also be given.

5.17.1.7 Monthly Progress Certificates/Progress reports

The Contractor shall submit agreed certificates for the site before the seventh day of the next month. These certificates shall state the percentage completion of each item in the schedules and shall state the overall percentage completion of the work. An updated S curve shall be submitted with the progress certificates.

5.17.1.8 Temporary Facilities

The Contractor shall provide all temporary buildings, equipment and cement stores, latrines required for his use. The Contractor shall agree the location of these buildings with the Employer, by submitting a drawing showing their location.

When a Contractor is placed in possession of the site, he shall erect temporary fencing immediately to protect the site until the boundary wall and gate shall be erected.

5.17.1.9 Site Supervision

Although the works may be let as a sub-contract to an approved local contractor, the main contractor shall ensure that an own supervisor in his direct employ is continuously available at the site during construction. This supervisor shall have a working command of spoken English and be able to read, understand and discuss specifications and drawings.

The Contractor shall notify the Employer in writing of every concrete pour and foundation casting the day before the work starts. This notification shall where requested by the Employer be given both to the Employer's Site Inspector and also the Employer's Project Director office.

5.17.1.10 Designs and Drawings

The Contractor shall agree with the Employer which codes of practice he will use before design work starts. All design and drawing work shall be completed by the Contractor, in direct co-ordination with the electrical plant design.

The Preferred Codes of Practice are:

Concrete design to BS 8110 including 0.IG earthquake force. Brickwork design to BS 5628, Wind loading to CP3 Chapter V, Foundation Design BS 8004 (includes piling) External rendered finishes BS 5262.

The Contractor shall supply one copy of all of codes for the Employer's design office at Dhaka. If non-English equivalent National codes are adopted the Contractor shall supply English translations of these Codes to the Employer.

One copy of calculations shall be submitted together with drawings. Calculations will not be approved separately from drawings, as misunderstanding may occur if these were done.

The Contractor shall generally submit a complete set of drawings for the sub-station for approval after initially getting the electrical layout of the sub-station approved. Where possible drawings shall be standardized and general drawing issued covering several sites.

The Contractor shall provide a co-ordination plan at scale 1;200 showing busbar sizes, structure types, foundation types, cable trenches, roads, ducts, fences, boundary walls, gate, earthing drainage and all services in this Contract.

5. 17.2 DESIGN

5.17.2.1 Architectural and Structural Requirements of Buildings.

All structures shall be designed to be architecturally pleasing in appearance and to withstand the tropical climate with minimal maintenance.

Architectural elevations of structures shall be agreed before other detail plans are prepared.

5.17.2.2 Ground Conditions, foundation and Site Investigation

Fill Sites

One every fill site the Contractor shall prove that his switchyard foundation will not suffer settlement greater than 20mm by building a foundation and load testing this to twice the design bearing pressure for a minimum of 20 days.

Outdoor equipment will be provided with spread footings. The Contractor will be provided by Employer with a survey of soil levels prior to filling. The Contractor shall impose the site layout on the survey to check for uneven of fill any foundation and where uneven depth of fill exists his foundation proposals shall restrict final differential settlement to a 1 in 400 slope.

Site Investigation

The Contractor may appoint a sub-contractor to carry out the site investigation but all work and all lab work shall be witnessed by one of his own of his own staff who shall countersign all recorded data.

The site investigation 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.

Bore holes shall be taken 10 meter below the equipment, switchyard structure and column foundation. The boreholes shall be located to an accuracy of ± 0.5m and shall be located to site layout.

Boreholes shall be a minimum of 10 meters depth or twice building footing width whichever is greater. All boreholes shall be back filled with compacted sand.

In each borehole the following tests shall be carried out:

Standard Penetration tests at 5.1 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 also be carried out on undisturbed samples taken at 1.5.3 and 4.5 meters depth. The sample shall be saturated and the range of applied pressure shall fully reflect the in situ conditions. Graphs showing void ratio(s) and applied pressure shall be submitted along with the Coefficient of Compressibility (Cc) for the range of loading anticipated. Ce shall be in m^2/year and shall be recorded at each load increment.

Particle size analysis shall be carried out for each strata and specific 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 until the water level remains constant for two days.

In cohesive soils a vane test to BS 1377:197 Test 18 shall be carried out at three different depths. The Contractor shall check the aggressivity of soil and ground water at each site to concrete and take all measures necessary to ensure the long term durability of concrete.

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 Employer. The report shall propose full details of foundations and loading thereon and shall provide estimate of likely settlement and differential settlements. The report shall be the work of the Contractor's own foundation Employers.

If the Contractor uses a local site investigation contractor he shall appoint one of his own staff to overseas the entire operation and each piece of data shall be countersigned by this person.

Where estimated settlement exceeds 25mm the Contractor shall construct one foundation at an early stage and test this foundation to confirm settlement prediction.

Foundations

The minimum depth of all foundations shall be:

(i)	All the switchyard foundations	...	1.1 m
(ii)	Boundary wall foundations	...	1.1 m

All formations shall be hand rammed or mechanically compacted before placing 70mm minimum thickness of Class B concrete blinding, within 24 hours of bottoming excavation, which blinding shall project 300mm minimum distance beyond all footings. The Employer shall inspect each footing. 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 Employer:
Blinding depth and projection shall be increased
Soft soil shall be removed and replaced with compacted viti sand with the top 200mm consisting of viti sand and brick chips.

The cost of this work shall be born by the Contractor

The Contractor shall propose the allowable bearing pressure for all foundations. This shall not exceed 125 kn/m^2 and shall be capable of resisting the earthquake load of 0.IG. All exposed concrete and the outer surface of cable trenches and cable tunnels shall receive two coats of bitumatic 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 shurry) before painting.

The Contractor shall monitor settlement of all foundations each month and report this settlement to the Employer until settlement has reduced to less than 1.5mm in 3 months.

The tops of all foundations shall terminate 300mm above site average finished surface level.

Excavation shall only be carried out when the ground water table is 400 mm below foundation level. The excavation shall be kept dry during the construction period by providing sumps and pumps as required. During the rainy season shelters shall be erected over all open excavations.

Any over excavation shall be filled with Class B concrete

All backfill shall be compacted to 95% maximum dry density as defined by BS 1377:1975 Test numbers 12.

Before starting foundation work the Contractor shall clear all sites of trees, and tree roots, shrubs, debris, surplus soil, and any buildings.

Foundations shall be designed to resist uplift assuming the water table is at ground level and the weight of soil resting on a foundation is that included within a 15^0 frustum.

5.17.2.3 <u>Drainage</u>

The entire surface within boundary wall shall have sloping at 1 in 150 minimum to open channels around the entire perimeter. These channels shall be designed for a rainfall intensity of 60mm per hour. The concrete wall of cables trenches shall project at least 70mm above brick paving level to prevent run entering the cable trench. The floors of all cable trenches/tunnels shall be sloped to soak ways. The cable trenches will thus form barriers to surface water drainage.

5.17.2.4 <u>Surfacing</u>

The Contractor shall provide gravels in the switchyard covering the total area of the yard as per direction of the Employer.

All areas to be surfaced shall first be treated with a total weed killer in accordance with the manufacturers instructions. Weed killer shall only be applied in dry weather when there is no risk of it being washed out to adjacent areas.

5.17.2.5 Roads

A 4.5 meter wide road within the site boundary shall be provided by the Contractor. plus entrance to the site boundary to connect to the adjacent public road. Road layout shall generally permit vehicles to turn easily. The Contractor shall design Road layout.

The road edge shall be formed by a flush Class B concrete kerbs 300mm wide by 250mm deep, placed over one layer of bricks laid flat. The road shall be a Class A concrete slab 150mm deep with 1:50 cross fall and stiff broom concrete finish reinforced with 10mm bars at 125mm centers longitudinally and 10mm bars at 400mm centers transversely placed 60mm below the upper surface. Extension and contraction joints shall be detailed on site slab shall be a layer of polythene 0.5mm thick laid over one layer of 1st class bricks laid on edge in herringbone fashion in and on cement mortar (mortar designation iv) laid over one layer of 1st class bricks shall be compacted as agreed with the Employer. If the soil is clay a 75m drainage layer of broken shall additionally be placed over the soil.

Where mortar designations are referred, it refers BS 5628 Mortar designation iv is 1 cement: 2 Lime: 8 to 9 sand.

5.17.2.6 Water supply

The water supply system required for the control room building. The Contractor shall be responsible for providing extra facility required for 33kV control room.

5.17.2.7 Plumbing and Sanitary Fittings

The Contractor shall be responsible only for sanitary fittings for toilets if required.

In the control room the toilet shall have single oriental WC pan with P trap with a low-level cistern of 10 liters capacity. Each toilet outlet shall be vented by a 100mm diameter ductile iron vent pipe passing up the outside of the building to 300mm above roof level. Beside each toilet shall be placed a low level tap. Control Building toilets shall also have a washbasin and cold-water shower. Toilets and showers shall have floors and walls tiled to a minimum height of 2.5m.

Every tap and cistern shall have stopcocks in the supply pipe. One external tap shall be provided. Battery rooms shall be provided with a stainless steel sink of approximate dimensions. All floor drains shall have P traps.

Mirrors shall be installed over toilet washbasins. Care shall be taken in orientation of toilets to avoid offending religious practices.

5.17.2.8 Control Building Floors

The floor of the 33kV control room at ground floor is finished without keeping any provision for official/operational purpose. 1st floor for control room & 2nd floor to be finished for keeping provision for BREB official purpose.

5.17.2.9 Battery Room Floors

Battery rooms shall have a concrete floor sloping to a cast iron floor drain. The concrete surface shall be treated with Nitocote epoxy resin coating (Nitoflor primer plus two coats of Nitocote in accordance with manufacturers instructions), or similar approved material, to ensure resistance to battery electrolyte. There shall be no cable trenches in battery rooms. Cable entrances through the floor shall be protected by a rained plinth 50mm high around the opening with the annuals around the cable sealed after installation.

5.17.2.10 Site Clearance, Obstructions and Adjacent Structures

The Contractor shall be responsible for clearance of:

Trees, shrubs and any vegetation including the extraction of all roots and compaction of backfill where roots have been extracted.

The removal of all buildings, sheds or any other structures above or below ground including the removal of any septic tanks, drains or other underground services.

The removal of any existing surfacing, roads, foundations or any other obstruction.

All material cleared away by the contractor shall be the property of the Employer and shall be removed by the Contractor to a site upon instructions of the Employer.

Where an existing service, existing equipment or adjacent building is to be retained the contractor shall take all necessary measures to protect the item concerned from damage and shall be responsible for ensuring that no movement of foundations occurs during or after completion of construction.

Any existing electrical equipment/cables which have to be modified or repositioned shall be included in the works at no extra cost. Any buried gas, electrical or water main services which require to be deviated shall be deviated by the Contractor at his own cost.

5.17.2.11 Boundary Walls, Fences and Entrance Gates

The Contractor shall base his design of boundary walls and gates on standard designs approved by the Employer. Where sites are within existing PGCB boundary walls the Contractor shall erect a permanent fence (if necessary, to be determined by the Employer) 2.9m high in accordance with BS 1722 part 10 or similar approved.

5.17.2.12 Brickwork

Bricks shall be first class bricks from approved manufacturers. 10 bricks shall be tested in accordance with BS 3921 to determine water absorption and crushing strength which shall exceed 20 N/mm^2. Mortar shall generally be of Mortar designation (iii) 1:4, cement, lime and sand.

Bricks shall be compacted down on to a full bed of mortar. Vertical joint shall be completely filled with mortar. Joints shall be raked out about 10mm deep where walls are to be rendered.

Brick walls shall be constructed so that tops of all walls are about the same level ± 0.75m. Only 18 courses per day shall be laid. New work shall be protected form sunlight and drying winds for 4 days.

Cement for all brickwork shall be stored in a dry building with a raised dry floor.

Reinforcement by mild steel rods shall be provided where required by the design. Additionally openings over 500mm wide shall be reinforced for 2 courses above and below the opening. 2 number 12mm bars per course extending 900mm beyond the opening both sides where possible.

All exposed brickwork shall be rendered and painted where not faced with facing bricks.

5.17.2.13 Extension Joint, Joint fillers and sealant.

Extension Joints shall be placed in floors beside all ground floor walls. All board shall be bitumen bound fibre board. Any expansion Joints on roofs shall be raised and protected by a metal flashing.

All expansion Joints shall be sealed by polysulphide sealant applied in accordance with the manufacturer'' instructions. sealant shall be oil resisting grade where required. sealant colours shall match or blend with adjacent wall colours.

5.17.2.14 Cable Trenches-Switchyards

Cable trench sizes shall be standardized. Layout drawings shall be submitted for the sub-station showing layout and size of trenches. No trench shall cross a road; power cables of 33 kV shall be placed in a tunnel of minimum 150mm diameter with bell-mounted ends. Both tunnels and ducts shall extend 1500mm minimum beyond the edge of roads. Spare ducts shall be installed for likely future development.

Floors and walls of trenches shall be constructed of Class A reinforced concrete of minimum 150 mm thickness with the external surface painted with two coats of bitumastic paint. Walls shall protrude at least 70mm above brick paving level and the top of the wall shall be flat with no BREBate. Floors shall be sloped at 1:150 minimum slope to brick soak ways placed below the trench at low points, the volume of each soakaway shall be $2.5m^3$ per $150m^2$ of trench.

Covers shall be of reinforced concrete Class A. Each cover should weight less than 55 kg. The minimum depth shall be 70 mm, with downstand ribs along each side providing a minimum overall depth of 100mm. The ends of the cover shall overhang the wall by 15mm and in the center of each end there shall be a hand hole of minimum size 100mm by 20mm high. This hole shall allow air to ventilate the trench so that heat built up in the trench shall be reduced. No gaps larger than 5 mm shall be left between adjacent covers so that the cables are always shaded. Cover slabs shall sit squarely and uniformly on the trench walls without the need to bedding or shims. Because portable fire extinguishers will be rolled over and along trenches, each cover shall be capable of resisting a 250kg point load at mid span. The contractor shall provide ramps up to the edge of covers in several locations, as agreed on site, to enable the wheeled extinguisher to mount the covers. Longitudinal edges may be inclined at 10^0 to the vertical thus creating a larger gap at the bottom of adjacent slabs, again to reduce heat build up. The upper surface of covers shall have a stiff broom non slip concrete finish. All sharp edges shall be stoned smooth. Outer edges shall be chamfered.

5.17.2.15 Cable Trenches in Buildings

The base and walls of the trench shall be of reinforced Class A concrete of minimum thickness 110mm with the outside face painted with 2 coats of bitumastic pain. Cable trays may be supported by Unistrut P3300 inserts or similar approved or drilled anchor bolts.

The building layout shows the duct through which the control cables shall pass to the 2nd floor of the control room building. At the 2nd floor the control cables shall pass along the outside of the wall and pass through the wall to beneath the control panel. Inside the control room the control cables shall be covered with sheet steel.

All covers shall bed down evenly. Full detailed fabrication drawings shall be provided by the Contractor for all coves.

5.17.2.16 Switchyard Foundations

The tops of all foundations shall be at the same level which shall be 300mm above general surface level. All exposed concrete surface shall be painted with bituminous paint and flat areas shall be sloped to shed water. No base shall permit ponding of water in any way, and free drainage shall also be possible from all areas inside any grouting.

Base shall generally be of Class A reinforced concrete but Class B concrete may be used for unreinforced massive foundations where bending stresses are nominal.

Bases shall have all recesses for cables and earthing. Where new foundations are adjacent to existing foundations the Contractor shall be responsible for verifying the extent of the existing foundation and ensuring the stability of the existing foundation.

5.17.2.17 Paints and Painting

All paints shall be of approved makes and colours and proven suitability for the prevailing climate and shall be approved by the Employer. All surfaces for painting shall be cleaned down prior to being painted and rubbed down to a smooth finish.

All externally exposed concrete and render of the control buildings, boundary walls blast walls and guard posts shall be painted with a fungicide and Snowcem primer and two coats of Snowcem. All exposed facing bricks and Snowcem painted surfaces shall be treated with one coat of clear silicone (5%) water proofing solution.

All exposed parts of foundations, the outer faces of cable trenches and cable tunnels shall be painted with two coats of bit-umastic paint.

All un-galvanized metalwork shall receive two coats of red oxide paint at least 4 days before installation and shall receive two finishing coats of paint after installation each coat being of different colour. Surface preparation before painting shall be SA 2.5 or an agreed rust converter acid, shall be used. All galvanized steel, including all brick ties, boundary wall wire supports, cranebeams, baseplates and holding down bolts and concrete plinths shall receive two coats of bitumastic paint. Galvanized steel shall not be painted until the surface has weathered.

Internal walls when fully dry shall have the surface rubbed down with sandpaper and be painted with a sealer and 2 finishing coats of plastic emulsion paint before equipment is installed. A further finishing coat shall be applied after completion of installation. One day shall be allowed for drying of each coat before the next coat is applied. The interior of all septic tanks and manholes carrying foul sewage shall received two coats of bitumastic paint.

All doors and wood frames and window cells shall be french polished.

5.17.2.18 Furniture, Cupboards, Tables, Desks and Shelves

The Contractor shall supply a complete set of 6 desk with 12 chairs, one drawing cabinets, lockable cabinets for spares and test equipment and key boxes in the control building as per requirement and subsequent approval of the Employer. These shall generally be of local hardwood or steel of local manufacture and shall be of robust durable construction.

The full details and specification of these materials shall be agreed before purchase. The Contractor shall arrange for a list of items to be handed over to the employer who shall sign that they have received a complete set as stated on the list.

5.17.2.19 Concrete

Only two grades of concrete shall be used. Class A shall be used for all structural work, piling and for all foundations which are not un-reinforced massive blocks. Class B concrete shall be used for blinding, pipe surround and un-reinforced or nominally reinforced concrete. Road slabs and floor slabs shall all be Class A concrete.

	Class A	Class B
Min. Cement Content	360 kg/m^3	170kg/m^3
Max. Water Cement ratio	0.35	--
Coarse Aggregate type	Broken stone	Jhama brick
Max. Coarse aggregate size	20mm (40mm piling)	25mm
Method of Batching	Volume batching	Volume batching
Min Characteristic of Trial Mix at 28 days	30N/mm^2	--
Min characteristic strength of trial mix at 7 days	14N/mm^2	--
Min characteristic strength of works cubes at 28 days	20N/mm^2	--
Slump Range	30mm min-100mm max	50mm min
Slump for concrete placed		
Below water in piling	150mm min	--

Please note, minimum specified water content will produce significantly stronger concrete. The Contractor's design shall be based on a 28 day crushing strength of 20 N/mm^2. Design shall be in accordance with this Contract and BS 8110 or other agreed standard.

Minimum cover to BREBars shall be 60 mm where concrete is in contract with back filled soil against a shuttered face, 100 mm where concrete is cast against soil, and 30mm for all above ground concrete. In detailing bars which traverse a member of reduction of 5mm shall be made for a bent bar and 10mm for a straight bar to ensure adequate cover. Exposed ends of sunshades and roof projection shall have 70mm minimum cover.

All concrete design shall ensure easy access for vibrators of 50 minimum diameter. Because of the slowness of concerting using local methods of transport congested reinforcement details and shapes which are difficult to concrete will not be used. The location of all cold joints shall be agreed in writing with the Employer and all joint surface shall be scabbled. All Joints shall be horizontal or formed against vertical stop ends. All cold Joints shall be indicated on drawings. Roof slabs shall generally be cast in one continuous operation.

5.17.2.20 Concrete Reinforcement

The Contractor may use locally available mild steel bars from approved sources. No bar or stirrup shall be smaller than 9mm diameter to ensure adequate rigidity during concerting.

If locally purchased bars are used bending tests and tensile tests shall be carried out to ensure the bars meet the design standard adopted, and weight per unit length tests regularly.

Bar bending lists shall generally be shown on drawings where possible with a diagrammatic representation of each bar to ensure clarity and case site communication. The Employer will not systematically check the accuracy of every bar on bar lists when approving drawings. The Contractor shall therefore arrange to check all bar lists. Drawings shall detail all chairs and ties and include these on bar lists.

Bars shall be tied at every intersection and the ends of tie wire bent away from concrete surfaces.

Anti crack bars shall be provided at changes in slab or wall thickness and at the corners of every rectangular opening.

5.17.2.21 External Render

All brickwork which is not faced with facing bricks shall be rendered. Concrete columns and walls shall be rendered and painted in accordance with BS 5262 with a 3 mm spattredash coat a 12mm undercoat followed by a 9 mm finishing coat. Surface preparation shall be as described in BS 5262. Joints shall be provided in all render where brickwork panels about concrete columns and grade beams as required by BS 5262.

A mix type II or III shall generally be used. The finishing coat shall be weaker than the undercoat.

The tops of all foundation blocks shall also be rendered, if required by the Employer, and all protruding concrete foundations shall also be rendered where required by the Employer.

PVC Bonding agents shall not be used because of the risk of early drying in the tropics. All concrete surfaces to be rendered shall have the entire surface scrabbled and brushed with a stiff brush to remove all loose material. The surface of the undercoat shall be roughened to ensure bonding of the finishing coat.

All render once completed shall be kept continuously damp for 10 days. After which it shall be treated with a fungicide. Any existing backgrounds shall be treated with a fungicide and all growth cleaned after 5 days of contact with the fungicide.

5.17.3 CONCRETE WORKMANSHIP

5.17.3.1 General

All stages in the production, mixing, placing and curing of concrete, the work will be inspected by the Employer’s representative. If any material, dimension or practice, is not at least equal to the standards set out, it shall be rejected an alternative, compliant with the said standards, and in addition, to the satisfaction of the Employer shall be implemented.

5.17.3.2 Aggregates

Coarse aggregate shall be capable of passing through a 20mm sieve and be retained on a 5mm sieve. Fine aggregate shall be not larger than 5 mm and not smaller than 0.06 mm and shall be sharp in texture.

All aggregate shall be free of harmful quantities of organic impurities, clay, silt, salt or unsound particles. The amount of clay silt and fine dust present in aggregate whether as coatings or separate particles may not be more than:

15% by weight in crushed sand
3% by weight in natural or crushed gravel sand
1% by weight in coarse aggregate

If the Employer considers that any aggregate which the Contractor proposes to use contains an excess of fine particles or any harmful substances, the Contractor will either replace the aggregate or at his option, and entirely at his expense, institute a series of approved tests at an approved laboratory (BRTC, BUET) to determine the nature and extent of the fine particles and harmful substances.

Following receipt by the Employer of the results of the analysis and tests, he will advise the Contractor in writing whether the proposed aggregate may or may not be used. The Employer's decision in this respect is final.

Tests to determine the extent of impurities or fine particles shall include (but shall not be restricted to) the relevant tests specified in BS 882: 1962, ASTM C40-66 (Colormetric test) ASTM C33-71A.

5.17.3.3 Sampling

At least four weeks before he envisages first receiving aggregate from any source the Contractor in the presence of the Employer shall obtain samples for testing. Samples shall be taken in accordance with the procedure quantities laid down in BS 812:1975 and shall be subjected to those tests which the Employer considers necessary to demonstrate the soundness of the material.

Such tests shall be carried out in an approved manner at the Contractor's expense and may include the manufacture both in the laboratory and at site, of test cubes or cylinders to determine crushing strength.

5.17.3.4 Grading

Tenderers should that they allow in their offer to the full cost of obtaining and transporting suitably graded stone aggregates.

Grading of aggregates should, together with the required minimum cement content and water cement ratio ensure adequate durability density and characteristic strength of the finished concrete. The Contractor will submit in writing to the Employer to make up of the mix he proposes to use together with the grading analysis for the particular material and any details concerning his or others experience with the use of aggregate obtained from the same source.

5.17.3.5 Cement

Ordinary Portland Cement shall comply with BS 12. The Contractor may obtain cement, bagged or in bulk, from any approved source in Bangladesh but shall always submit sufficient samples form each delivery, as required by the Employer, to ensure that all cement complies with the minimum requirements of BS 12. All cement shall be stored in a weather tight shed at least 300 mm off the floor. Regular checks shall be made on the weight of cement in each bag.

5.17.3.6 Water

All water used in the preparations of concrete for foundations shall be clean fit for drinking and free from all earth, vegetable matter and alkaline sub-stances whether in solution or in suspension, and shall comply with BS 3148.

5.17.3.7 Reinforcing

Where reinforcing is specified in any foundation design it shall comply with BS 4449 or an approved similar standard. Before any reinforcing is used the Contractor shall provide the Employer with a certified mill certificate verifying its grade and quality and proof test such samples as the Employer considers necessary. All reinforcement shall be clean and free from loose mill scale, dust, loose rust and paint, oil or any other coating which in the opinion of the Employer may destroy or reduce bond.

5.17.3.8 Storage

The Contractor shall ensure that all the materials he provides for the preparation of concrete shall be stored in a manner which prevents contamination by dust, clay, water or any other harmful material.

Heaps of coarse and fine aggregate shall be separated by a least one meter.

Where aggregate is tipped directly onto the ground the bottom 20 cm of the heaps shall not be used. Bagged cement shall be protected form rain, mixing water or damp soil during storage/transport. Cement from accidentally split or damaged bags shall not be used.

Where the Employer considers it necessary, special precautions shall be taken to ensure that aggregate stored on site shall remain dust free. Such precautions may include the bagging or aggregate at the pit if sites are adjacent to dusty roads, or if heavy rain is liable to wash out fine material or saturate the aggregate to an extent which might influence the water content of a mix.

5.17.3.9 Design Mix

Prior to ordering any aggregate the Contractor shall inform the Employer of the source (s) of his aggregates and deliver samples to the Employer. The Contractor will authorize at an approved laboratory tests (at BRTC, BUET) to show the sieve analyses, relative densities, moisture content of the samples of aggregate from each source. At least four test specimens of concrete shall be mixed at the approved laboratory and tested after 7 and 28 days.

Depending on the moisture content of the samples of aggregate, the Contractor will report to the Employer on the expected water/cement ratio and the aggregate/ cement ratio of concrete to be produced on site.

Following the successful testing of the laboratory samples, the Contractor will then make trial mixes at site (from which he will take at least 4 test specimens) using the proportions advised to the Employer (and in the presence of the Employer) and using the equipment he interds to use in the normal day to day manufacturing of concrete. The minimum 28 day crushing strength of any such test specimen shall be not less than 20. 7N/ mm^2

After successful testing of the test specimens made at site, the Employer may then approve the source (s) of aggregate and the mix design.

No changes to the approved mix design will be permitted unless the type or source of aggregate differs from those already tested, in which case further tests at both the laboratory (BUET) and at site will be made
Any concrete placed which does not conform to the approved mix designs shall be removed and replaced by the Contractor at his own cost.

5.17.3.10 Mixing and Placing of Concrete

Proportions of aggregates and cement and the quantity of water for each batch of concrete shall be closely monitored by an experienced mixer operator. Aggregate shall preferably be weight batched but where this is not possible, volume batching shall be permitted, provided that the net volumes or the loading equipment is approved by the Employer. Containers for measuring quantities of water shall be clearly marked and only approved quantities of water shall be used in the manufacture of concrete.

Mechanical mixers shall be in good condition and well maintained. After loading, the constituent parts of the concrete shall be mixed together for a period of not less than two minutes or 30 revolutions of the barrel whichever is the greater. For mixers with a capacity greater than 1.5 m^3 these periods may be increased if the Employer so requires.

When the ingredients are adequately mixed, the fresh concrete shall be discharged from the mixer and placed in the foundation with the minimum of delay. Shuts shall be used to ensure that fresh concrete is not dropped by more than 1.5 meters.

No concrete shall be placed until all form-work, installation of parts to be embedded, and preparation of surfaces involved in the placing have been approved. No. concrete shall be placed in or through water except with the written permission of the Employer and the method of depositing such concrete shall be approved by the Employer. Concrete shall not be placed in running water and shall not be subject to action of running water until after the concrete has hardened for seven days. All surfaces of forms and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed, mud or other foreign material, shall be cleaned of all such refuse before the surrounding or adjacent concrete is placed. Immediately before placing concrete all surfaces of foundations upon or against which the concrete is to be placed shall be free from standing water, mud and other foreign mater. The surfaces of concrete which have set, and against which new concrete is to be poured, shall be thoroughly cleaned to remove all foreign material and be saturated with water immediately before placing concrete. Concrete shall be deposited continuously and as rapidly as possible until the unit being poured is complete. If for any reason the work is stopped before completing the unit of operation a construction joint shall be installed in accordance with the instructions of the Employer. Concrete shall be so deposited as to maintain, until the completion of unit, a plastic surface approximately horizontal.

The method and equipment used for transporting concrete shall be such that concrete having the required composition and consistency will be delivered as near as practical to its final position without segregation or loss of slump. All concrete mixing and placing equipment and methods shall be subject to approval by the Employer. Concrete placement will not be permitted when, in the opinion of the Employer weather conditions or other pertinent factors prevent proper placement and consolidation.

Tenderers are reminded that as a minimum standard the following series of inspections should e carried out by the contractor before concerning can begin:

Shutters coated with mould oil and correct in type, quantity and condition.

Center lines of template to coincide at the center peg

Shutters to be well strutted and correctly located

Vibrator is to be in working order.

Mixer to be in working order

There is provision to maintain continuous mixing and pouring, by hand if necessary in the event of a mixer breaking down.

Where necessary, re-bar is no site ready bent and complete with tie wire, stirrups and concrete or plastic preformed spacer packs.

A reliable level is at hand
There is sufficient aggregate, cement and water to complete the pour.

Excavations are safe and not cluttered around the top edges

The mixer barrel is clean, and the paddles are complete and in place and the barrel will rotate at the speed specified by the Manufacturer.

A suitable shute is in place

Both an air thermometer and concrete thermometer are on site.

There is a large quantity of hessian sacking at hand

Where any of the above items are not complies with, the Employer may suspend concreting pending their implementation.

5.17.3.11 Testing of Concrete

Samples will be taken and tested in accordance with BS 1881:1970. Testing will be carried out by an approved laboratory (BRTC, BUET), who shall arrange to immediately notify the Contractor and the Employer in writing of any cube failure. Failed cubes shall be kept.

Concrete for the test specimens should be taken at the point of deposit. To ensure that the specimens are representative of the concrete, a number of samples shall be taken from different points. Each sample shall be large enough to make one test specimen and should be taken from one point in the work.
The testes specimens should be stored at the site at a place free vibration, under damp sacks for 24 hours ± 1/2 hour, after which time they should be removed from the moulds marked and stored in water at a temperature of 10^0 C to 21^0 C until the test date. Specimens which are to be sent to a laboratory for testing should be packed for transit in damp sand or other suitable damp material, and should reach the laboratory at least 24 hours before test. On arrival at the laboratory, they should be similarly stored in water until the date of the test.
One compression plate of the testing machine should be provided with a ball seating in the form of a portion of a sphere, the center of which coincides with the central point of the face of the plate. Test specimens should be placed in the machine in such a manner that the load is applied to the sides of the specimen as cast.
Cube strengths for concrete are to be not less than 13.8 N/mm^2 within seven days after mixing and 20. 7 N/mm^2 within 28 days after mixing.

One cube shall be tested at 7 days to obtain an indication of the concrete strength. The remaining there cubes shall be tested at 28 days and the average of their strengths shall be calculated. Should the average of the cube strengths fall below the specified 28 days cube strength, the Employer may order such concrete to be removed and replaced at the Contractor's expense, or the Employer may allow the Contractor to take a cylinder for further testing in accordance with BS 1881, if Schmidt hammer readings indicate below strength concrete.

The diameter of the cylinder, will be not less than three times the size of the maximum aggregate and its length will be at least double to the diameter – after allowing for preparation and facing prior to the test Both a report and compression test will be completed for the sample in accordance with BS 1881. Only one such test will be permitted from any one member and if the crushing strength of the sample is in excess of that required by the design, the Employer may, after the Contractor has made suitable repairs to the part disturbed by taking the sample, accept the concrete.

In addition to cube sampling 30% of concrete pours shall be tested by Schmidt hammer. The Contractor is to pay for all remedial work and testing. Readings shall be taken at locations agreed with the Employer and shall be witnessed by the Employer. At least 15 readings shall be taken such that after discarding the highest and lowest some 12 readings remain from which the mean shall be calculated. Reading shall be restricted to the middle third of a beam, slab or column and shall not be closer than 50 mm to an edge or closer than 50 mm to an other readings Immediately on completion of hammer testing the concrete surface shall be painted to seal it with two coats of snow-cem primer.

5.17.3.12 Shuttering

Shutters shall conform to the shape, lines and dimensions of the concrete as called for on the plans and shall be sufficiently strong to carry the dead weight of the concrete without under deflection or bulging, and sufficiently tight to prevent leakage of mortar. They shall be properly braced an tied together so as to maintain position and shape. Member sued in forms at exposed surfaces shall be dressed to uniform thickness and shall be free from loose knots or other defects. Joints in forms shall be horizontal or vertical. At all unexposed surfaces and rough work, undressed timber may be used. Timber reused in shutters shall have nails withdrawn and surfaces to be in contact with concrete thoroughly cleaned before being reused. Shutters shall not be disturbed until a minimum of 48 hours has passed from time of placement and concrete has hardened sufficiently to support any construction loads than may be imposed. When stripping forms, metal wedges or tools shall not be used to pry panels. If wedging is necessary, it shall be done with wood wedges lightly tapped to break adhesion.

5.17.3.13 Reinforcing Steel

Steel reinforcing bars shall be positioned in the concrete at the places shown on the drawings, or where reasonably directed by the Employer.

Before reinforcing bars are placed in position, surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease and all foreign matter. Once in position, reinforcing bars shall be maintained in a clean condition until they are completely embedded in concrete. Reinforcing bars shall have at least the minimum concrete cover as per standard practice. Reinforcing bars shall be accurately placed and secured in position such that they will not move during placing of concrete. Per-cast concrete block spacers may be used for supporting reinforcing bars.

5.17.3.14 Consolidation of Concrete

Concrete shall be consolidated to maximum practical density, without segregation, by vibration so that it is free from pockets of coarse aggregate and closes against all surfaces and embedded materials. Vibration of concrete in structures shall be by electric or pneumatic-driven immersion type vibrators of 50mm minimum diameter, operating at speeds of at least 8,000 rpm when immersed in concrete. The vibrator shall be inserted vertically at close enough intervals so that the zones of influences overlap. The vibrator shall be inserted to the full depth of the layer being treated and withdrawn slowly. When concrete is being placed in layers, the tip of the vibrator shall extend approximately 100mm into the underlying layer. Vibrators shall not be used to move concrete horizontally. Care shall be exercised to avoid over-vibration of the concrete and direct contract between the vibrator and reinforcing shall be avoided.

5.17.3.15 Curing of Concrete

For foundations where excavations are to be back filled immediately following the striking of shutters, the concrete is to be thoroughly wetted before back filling commences. Where shutters are to be struck filling of the excavation is not to take place immediately, the concrete is to be covered with wetted hessian sacking and be enclosed in polythene sheeting to avoid drying of the concrete. In all cases concrete exposed to the sun shall be kept moist and cool for a period of five days after casting.

5.17.3.16 Hot Weather Concreting

In hot weather the following additional precautions shall be taken

In hot weather suitable means shall be provided to shield the aggregate stockpiles form the direct rays of the sun or to cool the mixing water/aggregates to ensure that the temperature of the concrete when deposited shall not exceed 32^0C.

In hot dry weather suitable means shall be provided to avoid premature stiffening of concrete placed in contact with hot dry surfaces. Where necessary the surfaces including reinforcement, against which the concrete is to be placed shall be shielded from the rays of the sun and shall be sprayed with water to prevent excessive absorption by the surfaces of water from the final concrete.

5.17.4 FACTOR OF SAFETY

Unless otherwise stated, the factor of safety (F.O.S) of all reinforced cement concrete shall be not less than 2.5.

5.17.5 WORKMANSHIP OF ALL OTHER MATERIALS

This specification only describes concrete work in detail. All other materials workmanship shall be in accordance with an agreed standard. Before starting any new item of work the Contractor shall submit samples of the materials to the Employer for approval in writing and the method of installation shall also be approved. The first item of any type to be installed shall be inspected and checked in detail by the Employer before other items are constructed.

5.18 QUALITY ASSURANCE, INSPECTION, TESTING, COMMISSIONING AND WARRANTY

5.18.1 SCOPE OF SECTION

The whole of the plant covered by this Contract will be subject to inspection and witnessing the tests by the Employer during manufacture, erection and on completion. The inspection and witnessing the tests at manufacturer's works may be done by the Employer or an Independent Inspection agency. The approval of the Employer for passing of any such inspection of test will not, however, prejudice the right of the Employer to reject the plant if it does not comply with the specification when erected or when in service.

Included in the Contract price for this lot is the cost of training on substation design and operation & maintenance of substation and the Instruction of Employer's staff on site.

Within 40 days of the Letter of Acceptance for the Contract the Contractor shall submit a quality assurance program and a work quality program for the Employer's approval. It shall be submitted on the Employer's standard form, a sample of which is included at the end of this Section.

The Contractor shall have an approved Quality Management System complying with BS5750 Part 1 or CEN 209001, which shall cover all activities being undertaken during the design, procurement, manufacturing, inspection, testing, packing, shipping, storage, installation and erection and commissioning of the Works.

After the award of Contract, the Employer shall have the right to carry out a review of the quality assurance procedures operated by the Contractor. The Employer's review may consider quality assurance in relation to the design and manufacture of plant items, but may equally investigate the Contractor's quality assurance procedures for the overall control of the wide range of design activities necessary for a complex project of this type, and the dissemination of paperwork, design drawings and data amongst the various design and manufacturing organizations within the Contract. The Contractor shall give all necessary help and assistance to the Employer in carrying out such a quality assurance review. The Contractor shall consider and discuss the results of the review and make any reasonable improvements in these procedures.

30 days notice shall be given when the plant is ready for inspection or tests and every facility shall be provided by the Contractor and his Sub-Contractors to enable the Employer to carry out the necessary inspection and witnessing of tests.

In the cases where tests or inspection are specified as being carried out on only a sample of the total quantity of items in the Works, and where one or more items of the sample fail the test or inspection, a further batch of the items, at equal in quantity to the proportion originally.

5.18.2 GUARANTEES

The Contractor shall state and guarantee the technical particulars listed in the Technical Schedules and other section as specified by the Contract for testing procedures. These guarantees and particulars shall be binding and shall not be departed from without the written permission of the Employer. The Contractor shall further guarantee that all equipment supplied complies with the Contract Documents.

The tolerances permitted in the IEC and British Standards shall apply unless otherwise stated.

5.18.3 MEASURING AND TESTING EQUIPMENT

At prescribed intervals, or prior to each use, all measuring and testing equipment used in inspection shall be calibrated and adjusted against certified equipment having a known valid relationship to internationally recognized standards.

The manufacturer shall prepare a calibration schedule showing equipment type, identification number, location, frequency of checks, method of checking and action to take when results are unsatisfactory.

5.18.4 INSPECTION PLAN AND PROCEDURE

The inspection Plan, as submitted by the Contractor to the Employer for approval, shall cover the following:

(a) Relevant British Standards or equivalent International Standard. For each of the following stages of the work-the acceptance criteria shall be stated.

(b) The stages of inspection, which shall include but not be limited to the following:

i) Tests review or approve certification of material;
ii) Review and approval of manufacturing procedures;
iii) Witnessing tests or review and approval of certification of operator's qualification to carry out the work required;
iv) Visual and dimensional examination of components;
v) Pressure tests on casings and vessels;
vi) Non-destructive examination of materials in progress;
vii) Functional tests on sub-assemblies, performance tests, type tests on complete units.
viii) Examination of painting, packing and documentation for shipment.

The Employer will indicate the inspection requirements on the agreed inspection program in accordance with the following.
Hold point-Requires a mandatory inspection by the Employer. This inspection or test shall be witnessed by the Employer.

Witness point-Inspection or test of material may be carried out by the Employer at their discretion.

5.18.5 TEST CERTIFICATES

Triplicate sets of all test records, test certificates and performance curves, whether or not they have been witnesses by the Employer, shall be supplied for all tests carried out in accordance with the provisions of this Contract.

All test documentation shall be in the English language.

5.18.5.1 Testing of Plant

Tests at manufacturers' works shall include mechanical electrical and hydeaulic tests to ensure that the plant being supplied complies with the requirements of the Specification.

Works tests shall include all routine electrical, mechanical and hydraulic test in accordance with the relevant IEC or British Standards, except where departure there from and modifications thereto are embodied in this Specification.

The Employer or its representative or independent inspection agency may witness the tests. Sufficient notice (minimum of 30 working days) shall be given to enable the necessary arrangements to be made.

If the plant, or any portion thereof, fails under test to give the required performance, such further tests which are considered necessary by the Employer shall be carried out by the Contractor and the whole cost of the repeated tests shall be borne by the Contractor.

Tests shall be conducted in accordance with the specified standards. Where no standards are specified the procedure shall be agreed between the Employer and the Contractor.

5.18.5.2 Relays

All relays and associated equipment shall be routine tested to prove the quality and accuracy. Routine tests shall be in accordance with relevant IEC Recommendations and BS 142:1966, supplied by additional tests as are considered necessary by the Employer. Routine test reports shall be submitted for each relay and piece of equipment. The reports shall record all measurements taken during the tests.

All relays shall be subjected to the appropriate routine tests as listed below, the individual tests being as detailed in IEC 255 or as otherwise agreed with the Employer.

(a) Accuracy of calibrated pick-up and drop-off levels over the effective range of settings

(b) Insulation tests

(c) Accuracy of timing elements

(d) Correct operation of flag (or other) indicators

(e) Mechanical requirements integrity/safety of draw-out units-check of contest pressure and alignment.

5.18.5.3 Electrical Instruments and Meters

One instrument and meter of each type and rating shall be subjected to the tests as specified in IEC 5.1.

5.18.5.4 AC Switchboards

Routine tests shall include general inspection and electrical operation tests.

5.18.5.5 Contactors

One contactor of each type and rating shall be subjected to type tests as specified in IEC292.1

5.18.5.6 PVC Cable

Each size and rating of PVC cable shall be subjected to type tests as specified in BS 6346.

5.18.5.7 Switchgear

For 33kV rated circuit breakers the short circuit type tests shall be performed using test circuit arrangements having inherent rates of rise of restricting voltage based on a first pole to clear factor of 1.5.

The remaining circuit breakers of each type shall be ether fully assembled at the manufacturer's works and subjected to operation tests and power frequency tests or where not assembled at works, separate power frequency voltage tests shall be performed on all ma or insulation components.

Routine tests in accordance with IEC 56 or ANSI C37 shall be carried out on all circuit breakers. There shall include operation tests, mill volt drop tests and power frequency voltage tests.

5.18.5.8 Disconnectors and Earth Switches

Routine tests to IEC 129:1975 (BS 5253:1975).

Routine tests to IEC' 265 for switch disconnection.

Routine high voltage and mechanical test of insulators

5.18.5.9 Current and Voltage Transformers

Routine tests to IEC 185 (BS 3938:1973) and IEC 186 (BS 3941:1975).

5.18.5.10 Structures of Electrical Equipment

Sample tests on the assembly and galvanizing of the structures shall be carried out. A mechanical type test with the structure loaded with working load multiplied by the appropriate factor of safety shall be carried out.

5.18.5.11 Surge Arresters

Routine tests to be specified standards shall be carried out.

Routine to IEC 99.4.

The following routine tests shall be carried out on all arrester units in accordance with clause 8.1 of IEC 99.4.

(a) measurement of reference voltage
(b) residual voltage test
(c) partial discharge test
(d) housing leakage test
(e) current distribution test for multi-column arrester.

The following acceptance tests shall be carried out on one complete arrester of each voltage rating and/or type being supplied all in accordance with Clause 8.2 of IEC 99.4.

(a) measurement of power frequency voltage at reference current
(b) lightning impulse residual voltage at nominal discharge current
(c) partial discharge current
(d) accelerated ageing test followed by an operating duty test-details are to be agreed with the Employer.

5.18.5.12 Batteries and Battery Chargers

Battery	-	The Contractor shall demonstrate that the battery will perform the duties specified.
Battery Charger	-	Routin tests according to IEC 146:1973 (BS 4417:1969)
DC Switchboard	-	Routine tests according to IEC 439:1973 (BS 5486: Part 1.1977).

Complete charge and discharge tests on each of the combined batteries and chargers shall be conducted and results recorded so as to permit verification of the ampere-hour capacity of the battery. During these tests the Employer shall select at random reference cells and the voltage curves thereof shall be checked when the battery is discharged over three and ten hour periods. The alarm levels and the automatic voltage control feature of the charger shall be demonstrated over the specified load range. Where load changeover facilities are included, integrity of the changeover system without break or voltage variation during loading of the standby or test charger shall be demonstrated.

5.18.5.13 Control Panels

Routine operation tests and insulation resistance tests shall be carried out.

5.18.5.14 Busbars

Routine tests including mill-ivolt drop tests shall be carried out in accordance with the specified standard.

5.18.5.15 Instruments

Calibration test shall be witnessed on all important pressure gauges and other instruments as required by the Engineer.

5.18.5.16 Galvanizing

Routine Tests

To the requirements of BS 443 or BS 729 whichever is applicable

5.18.6 ISNSPECTION AND TESTING DURING SITE ERECTION

5.18.6.1 GENERAL

The Contractor shall be responsible for the submission to the Employer of al plant supplied under the Contract for inspection and testing during site erection, to ensure correct erection and compliance with the Specification.

During the course of erection, the Contractor shall provide access as required by the Employer for inspecting the progress of the works and checking its accuracy to any extent that may be required.

The Contractor shall provide, at his own cost, all labour, materials, stores and apparatus as may be requisite and as may be reasonably demanded to carry out all tests during erection, whether or not the tests are specifically referred to in this specification.

Tests on completion of erection shall be carried out by the Contractor in accordance with the General Conditions of Contract. The Contractor shall provide all necessary test equipment to carry out the site tests, but where required in the Schedule of prices shall include the cost of the equipment so that the Employer may have the option to buy the equipment on completion of the Contract.

The contractor shall submit a written program of tests and checks according to this Clause for the approval of the Employer.

A brief description of all tests and testing procedures shall be provided before tests commence and the method of testing, unless otherwise specified, shall be agreed with the Employer.
The Contractor shall provide experienced test personnel and testing shall be carried out during normal working hours as far as is practicable. Tests which involve existing apparatus and outages may be carried out outside normal working hours. The Contractor shall give sufficient notice to allow for the necessary outage arrangement to be made in conformity with the testing program.

The Contractor shall advise the Employer in writing, at the time commencement of site erection, of the site supplies which will be required for the operation of the test equipment to enable the Employer to arrange accordingly or to agree alternative arrangements should this be necessary.

The Contractor shall record the results of the tests clearly, on an approved form and with clear reference to the equipment and items to which they refer so that the record can be used as the basis for maintenance tests during the working life of the equipment. The required number of site test result records shall be provided by the Contractor to the Employer as soon as possible after completion of the tests.

No tests as agreed under the program of tests shall be waived except upon the instruction or agreement of the Employer in writing.

The Contractor’s test equipment shall be of satisfactory quality and condition and where necessary, shall be appropriately calibrated by an approved authority at the Contractor’s expense. Details of the test equipment and instruments used shall be noted in the test sheets in cases where the instrument or equipment characteristics can have a bearing on the test results.

The testing requirements details under this Specification may be subject to some variation upon the instruction or agreement of the Employer where necessitated by changed conditions at Site or by differing design, manufacture, or construction techniques.

5.18.6.2 ELECTRICAL EQUIPMENT

5.18.6.2.1 General

A general check of all the switchgear and ancillary equipment shall be made and shall include a check of the completeness, correctness and condition of earth connections, labeling, arcing, ring and horn gaps, clearance, painted surfaces, cables, wiring, pipe work, valves, blanking plates and all other auxiliary and ancillary. Checks shall be made for oil and gas leaks and that insulators are clean and free from external damage. A check shall be made that loose items which are to be handed over to the Employer are in order and are correctly stored or handed over.

The following general tests are to be carried out on electrical equipments site erection at site.

(a) Routine high voltage tests to the appropriate IEC Standard. Where no relevant standard exists, tests shall be agreed with the Employer.

(b) Insulation resistance tests on all electrical equipment

(c) Continuity and conductivity resistance tests

(d) Test operation of alarm and tripping, devices to local and remote

(e) Rotational tests a on all motors

(f) Polarity tests on CTs and VTs

(g) Oil tests

(h) Grounding system and electrode tests

(i) Ratio, Vector Grouping and magnetizing current tests on each transformer

(j) Calibration of winding and oil temperature devices

(k) Vector group and phasing tests on VT circuits

(l) Magnetization current/voltage tests and winding resistance tests on all current transformers.

(m) Primary and secondary injection tests on relays, protection devices and equipment

5.18.6.2.2 Circuit Breakers

Circuit breakers shall be given a visual inspection:

Contact resistance tests shall be carried out. In the case of multi-interrupter circuit breakers resistance tests will be required at each interrupter or pair of interrupters as well as through the series of interrupters on each pole.

Operational tests shall include local and remote trip/close. Timing shall be carried out on all circuit breakers.

5.18.6.2.3 Dis-connectors and Earth Switches

Manual operation of dis-connectors and earth switches shall be subject to operational tests to confirm contact pressure contact resistances, simultaneous operation of all phases and the case of operation.

Checks shall be made on interlocks, local and remote indications and operation of auxiliary contacts.

Each switches shall be tested to confirm the opening and closing sequences and checks shall be made on interlocks indications and manual locking devices.

5.18.6.2.4 Busbars and Connections

Flexible bus-bars and connections shall be tested to ensure that the correct tensions, sags and clearances will be maintained over the range of environmental conditions and loads without tress to other equipment. If dynamometers are used to check the sags and tensions, they shall be checked both before and after use.

Rigid bus-bars and connections shall be tested to ensure that the bus-bars will not cause overloading of the supporting insulators under load conditions and under the range of climatic variations applicable to the site and that expansion and contraction of the equipment is fully accommodated by flexible connections.

Conductivity tests shall be carried out on all connections and joints which are made on site without exception.

5.18.6.2.5 Earthing System

Tests shall be made on the effectiveness of the bonding and earthing which will include conductivity tests on selected joints on the main earthing system, and at the connections to equipment and structures. Checks shall also be made to avoid corrosion attack on the earthing system.

Test probes at approximately 300 and 600 meters separation will normally be required to effectively test the earthing system. The use of transmission line conductors may be arranged to simplify there testing procedures.

The earth resistance shall be measured during the installation and on completion as follows:

(a) of each earth rod after driving
(b) of the earth grid after completion and backfilling of the trenches
(c) of each group of earth rods or earth point after completion of the connection from the test link terminal.

(d) of the completed installation without any connections outside the substation

The tests shall be carried out by method and with equipment approved by the Employer. All tests are to be witnessed and the equipment and method used recorded with the test results.

The Contractor may also be called upon to provide assistance in the measurement of earth resistance after earth connections to the system have been completed.

5.18.6.2.6 Control Relays and Metering Panels, Instruments and Protective Devices

(a) Wiring

After complete erection and cabling all circuits shall be subjected to the high voltage test specified in the relevant IEC or approved standard.

The insulation resistance of all circuits shall be measured before and after any high voltage tests.

For AC secondary injection tests a substantially sinusoidal test supply shall be sued.
The operating and resetting level and timing of all relays shall be measured over an agreed range of settings for all relays.

All DC elements of protection relays shall be tested for operation at 70% rated voltage

All DC supplies shall be checked for severity of current inrush when energized by switching on or inserting fuses or links.

(b) Mechanical Inspection

All panel equipment is to be examined to ensure that it is in proper working condition and correctly adjusted, correctly labeled and that cases, covers, glass and gaskets are in good order and properly fitting.

(c) General

Sufficient tests shall be performed on the relays and protection schemes to:

i) establish that the equipment has not suffered damage during transit.

ii) establish that the correct equipment has been supplied and installed

iii) confirm that the various items of equipment have been correctly interconnected

iv) confirm performance of schemes designed on the bases of calculation e.g differential protection.

v) to provide a set of figures for completion with future maintenance values allowing the condition of the equipment to be determined.

(d) Secondary Injection

Secondary injection shall be carried out on all AC relays, using voltage and current of sinusoidal wave form and rated power frequency to confirm satisfactory operation and range adjustment.

The fault setting for the type of protection is to be established by secondary injection where it is impracticable to ascertain this value by primary injection. Injection is to be made across the appropriate relay bus wires all associated relays, setting resistors and CTs connected.

(c) Primary Injection

All current operated relays shall be tested by injection of primary current to record the actual relay setting and as a final proof of the integrity of all secondary connections.

Primary current injection tests are to be carried out by the Contractor and the methods employed for a particular installation are to be agreed with the Employer.

Tests are to be carried out as follows:-

i) Local primary injection to establish the ration and polarity current transformers as a group, care being taken o prove the identity of current transformers of similar ration.

ii) Overall primary injection to prove correct interconnection between current transformer groups and associated relays.

iii) Fault setting tests, where possible to establish the value of current necessary to produce operation of the relays.

(f) DC Operations

Tests are to be carried out to prove the correctness of all DC polarities, the operating levels of DC relays and the correct functioning of DC relay schemes selection and control switching, indications and alarms. The correct functioning of all isolation links and fuses shall also be checked.

(g) Tests on Load

Tests on load shall also be done to demonstrate stability and operation of protection relays as required by the Engineer.

All tripping control, alarm and interlocking circuits shall be functionally tested to prove satisfactory and foolproof operation and/or resetting. The functional and safety aspects of all shorting and/or isolation links, fuses and switches devices shall be proved.

The total busbers connected to all voltage transformer circuits shall be measured and recorded.

The total capacitance of all wiring and apparatus connected to the negative pole of each main tripping battery shall be measured and recorded, the value shall not exceed 10 microfarad.

The continuous current drain of all trip circuit supervision relays shall be measured and shall no be greater than half the minimum current required for tripping. The supervision current shall be measured with the circuit breaker (or other device) both open and closed.

5.18.6.2.7 Batteries and Chargers

Tests shall be carried out on the batteries and chargers to confirm the charger ratings and adjustment, the battery and charger alarm systems and battery capacity.

The open-circuit cell voltages of the batteries when fully charged shall be recorded.

5.18.6.2.8 Power Cables

Each completed circuit shall be tested for continuously and insulation resistance.

5.18.6.2.9 Current Transformers

A magnetization curve shall be obtained for each current transformer in order to:-

(a) Detect damage in transit or installation

(b) Prove that the correct cores have been wired out to the relevant terminals

(c) For high impedance relay schemes, to confirm that correct relay settings have been calculated.

The DC resistance of each current transformer secondary winding shall be measured and recorded.

Primary current injection tests shall be conducted on all current transformers using adequate primary current to prove current ration, polarity and for differential protection schemes to prove the correct relative polarities of all current transformers f each scheme.

5.18.6.2.10 Voltage Transformers

The transformer ratio and polarity shall be checked using a primary voltage high enough to give a clearly measurable secondary voltage or by using rated primary voltage and comparison with an already proven voltage transformer. The phasing and phase rotation shall be checked. For three phase voltage transformers a test shall be conducted to show that each primary winding products an output from only the correct phase secondary winding. The residential voltage of any open delta or broken delta winding shall be measured with rated primary voltage applied.

5.18.6.2.11 Control and Instrumentation Equipment

The following general tests shall be performed on control and instrumentation equipment at site.

(a) High voltage testing of all circuits as specified in the relevant IEC or approved standard

(b) Insulation resistance testing of all circuits

(c) Functional tests of all tripping control, alarm and interlocking circuits

(d) The testing of all equipment in accordance with the manufacturer's instructions or as advised by the Engineer.

5.18.6.2.12 Transformers and Ancillary Equipment

The following tests shall be performed

i) Insulation resistance tests on business

ii) Insulation resistance test at 500V between core and core clamping structure.

iii) Voltage withstand tests on insulating oil to BS 148

iv) Ratio

v) Phase relationship

vi) Magnetization characteristics of current transformers of winding temperature device

vii) Calibrated of winding temperature devices

viii) Tap Selector and Diverter Switch alignment

ix) Calibration of automatic voltage control equipment

x) Proving tests as necessary on control schemes

xi) Measurement of winding resistance on all laps and phases

5.18.6.3 STAFFING

During pre-commissioning the Contractor shall provide all necessary supervisory and opening staff. The only involvement of the Employer's staff will be in accordance with the training and instruction as in this specification.

During the commissioning phase, the Employer's operating staff will operate plant and equipment under the supervision of the Contractor's supervisors.

The Contractor shall have satisfied himself as to the capability of the Employer's operators to carry out such operations as he may direct and shall remain responsible for the successful performance of such operations. Throughout the whole of the Commissioning Period the Contractor shall provide suitably qualified and experienced operating staff, who shall instruct the Employer's staff in the correct operating procedures.

At all times the Contractor shall ensure that his staff and seconded staff observe all prescribed safety rules and permit systems.

5.18.6.4 TAKING OVER

After satisfactory completion of the tests on completion, the Employer will issue a Taking Over Certificate for the plant. The issue of any such certificate shall not however relieve the Contractor of any of his responsibilities in respect of proving that the performance of the plant meets the guaranteed values.

The Taking Over Certificate shall make reference to a schedule of outstanding minor defies and omissions which have been accepted by the Employer as not affecting the full and safe operation of the plant. The Contractor shall rectify such defects and omissions not later than 3 months after Taking Over.

The date certified in the Taking Over Certificate shall be the date on which the tests on completion were completed.

5.18.6.5 DEFECTS AFTER TAKING OVER

In accordance with the General Conditions of Contract the Contractor shall be responsible for making good defects or damage which may appear or occur during a 36 (thirty-six) months warrantee period from the date certified in the Taking Over certificate.

Following remedial work or replacement of any component part during the 36 months the warranty period for such a part shall be extended commencing from the date at which the remedial work was completed.

Immediately prior to the completion of this period the Employer reserves the right to request the Contractor to open up for inspection the whole or any part of the Plant. The employer will provide the labour to work under the direct supervision of the Contractor's representative for the purpose of such inspection.

The Contractor shall submit for approval the arrangements he intends making under this Contract for the making good of defects and for providing the supervisory service detailed above.

5.18.6.6 FINAL ACCEPTANCE CERTIFICATE

Application for the Final Certificate may be made to the Employer after the Contractor has ceased to be under any obligation under the Contract. This shall include the submission of final contract record drawings and fully bound version of the Installation, Operation and Maintenance Manuals. If a taking over Certificate has been issued in respect of any Section or Portion of the Works. Only one Final Certificate will be issued after all the said obligation has ceased. Where the Contractor has carried out replacements or renewals to the Works, the Contractor's obligations shall continue, but the right of the Contractor to apply for a Final Certificate other than for the replacements or renewals shall not be affected by that fact.

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

TENDER DOCUMENT
FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

VOLUME 3 OF 3

SECTION:8-PARTICULAR SPECIFICATIONS AND SCHEDULES

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

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SCHEDULE A

INTRODUCTION AND PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE A

INTRODUCTION AND PREAMBLE TO THE PRICE & TECHNICAL SCHEDULES

A1: BRIEF DESCRIPTION OF THE WORKS.

The work comprise of creating facilities for 07 (Seven) nos. 33kV outgoing feeders through extension of 04 nos. 33 kV Bay of existing 33kV Bagerhat switching yard and installation of new Bus-bar & related works for Bagerhat PBS at Bagerhat 132/33 PGCB Grid Sub-Station.

Outdoor switchyard:

The extension of Switchyard shall Comprise of Steel Structures for 07 nos. 33 kV outgoing feeders. The Bus-conductor shall be 2×Martin (2500A). The steel structure columns and electrical equipment shall be installed on steel supports with RCC Foundation.

Civil works:

The civil works on this Contract shall include site development, construction of two storied control room building with 03 storied foundation, RCC Power cable and Control cable trench, Foundation of Gantry structure and equipments, surface finishing with gravels, internal roads, surface drains & apron (if applicable) etc. as per requirements for complete of Bay-extension work and approved design & Drawing and instruction of BREB Employers.

33kV Bus- Isolator:

Design, supply, delivery, installation, testing & commissioning of 01 no. 33kV 2500A capacity Bus-isolator without earthling switch for connecting existing and extended 33 kV Bus-bar.

33kV Outgoing Feeders:

Design, supply, delivery, installation, testing & commissioning of 07 nos. of 33kV 1250A capacity vacuum circuit breakers for 07 nos. outgoing feeders each with one set of CT with ratio 800-400/5-5-5A, one set of isolator of capacity of 1250A without earthing switch for bus side connection, one set of isolator of capacity of 1250A with earthing switch for line side connection and one set of lightning arresters.

33kV Single Phase Current Transformers (Incoming): If Applicable

Design, supply, delivery, installation, testing & commissioning of 02 sets (6 nos) of single phase current transformers will be required for the proposed 2 feeders. The feeder CTs shall have 3 cores, core 1 shall have ratio 2400-1600/5-5-5A, 30VA, M0.2 for indicating meters on control panels, core 2 shall have ratio 2400-1600/5-5-5A, 30VA M0.2 dedicated for the energy meters to be installed in a separate energy metering panel and core 3 shall have ratio 2400-1600/5-5-5A, 30VA, 5P20 for protection. Burden shall be calculated as per Field Condition and Resistance of the Instrument Cables.

33kV Single Phase Current Transformers (Outgoing):

Design, supply, delivery, installation, testing & commissioning of 07 sets (21 nos.) of single phase current transformers will be required for the proposed 07 feeders. The feeder CTs shall have 3 cores, core 1 shall have ratio 800-400/5-5-5A, 30VA, M0.2 for indicating meters on control panels, core 2 shall have ratio 800-400/5-5-5A, 30VA M0.2 dedicated for the energy meters to be installed in a separate energy metering panel and core 3 shall have ratio 800-400/5-5-5A, 30VA, 5P20 for protection. Burden shall be Calculated as per Field Condition and Resistance of the Instrument Cables.

33kV Single Phase Voltage Transformers:

Design, supply, delivery, installation, testing & commissioning of one sets (3 nos.) of 33kV single phase voltage transformers to be installed at the two ends of structures in the switchyard for bus VT. For all VTs core 1 of secondary winding of accuracy class 0.2 and capacity 50 VA will be dedicated for energy meters only and core 2 of accuracy class 3P and capacity 50 VA will be used for indicating meters on the control panels.

33kV Control Panels:

Design, supply, delivery, installation, testing & commissioning of control panels for 33kV vacuum circuit breakers for 07 nos. outgoing feeders including all control cables and AC/DC supplies.

Energy Metering Panel:

Design, supply, delivery, installation, testing & commissioning of one no. energy meter panel having space provision for installation of 10(Ten) nos. energy meters and 7 nos. energy meters for 7 nos. outgoing feeders. Dedicated supply from both CTs and VTs will be drawn directly to the metering panel.

110V Battery and Battery Chargers:

Existing Battery and Battery charger in control room building shall be replaced by supplying and installation of one set of new batteries and battery charger in the control room including all power and control cables.

LV AC / DC Panels: (If Required)

Design, supply, delivery, installation, testing & commissioning of one set of low voltage AC distribution panel in the control room to provide 415/230V supplies to all equipment being supplied with necessary 3-phase MCCBs and one set of DC distribution panel in the control room to provide 110V DC supplies as required and including all power and control cables .

Earthing System:

Design, supply, delivery, installation of earthing system and lightning protection screen including connections, connectors and clamps to suit the switching station overall arrangement and provide supporting design calculations. However the design and installation of earthing system done by PGCB/PDB should be followed for the 33kV existing switching station also. Grounding resistance to be maintained less than 0.2 ohm.

Multi core Control / Power cables:

Complete set of multi core low voltage auxiliary power and control cables between all items of equipment required under this contract shall be supplied, installed, landed, terminated and have individual cores identified. The production of the overall switching station cable routing and core schedules shall also be provided. The multi core control cables shall be installed in such a way that those shall enter into the existing control room building through the newly constructed and existing duct and laid on a suitable cable tray as per direction of Engineer-in-charge. All control cable size should be 4/6 rm and above if required.

Building Lighting, Small Power, Air Conditioning and Ventilation : (If Applicable)

Complete design and calculations supply, delivery, installation, testing & commissioning of equipment to provide lighting ,LV power supply and air conditioning system and emergency DC lighting at strategic location for equipment operations and inspections. Approach rood, cable trench etc. to be constructed by the contractor.

Switchyard Lighting: (If Applicable)

Complete design and calculations supply, delivery, installation, testing & commissioning of equipment to provide lighting (sodium light) for security, roadway and switchyard and emergency DC lighting at strategic location for equipment operations and inspections.

Training:

The Contract Price shall include all costs for training of Employer's representatives at site. Four Engineers (Two from REB and two from PBS) nominated by the Employer shall be given on job training at the time of installation as well as testing & commissioning of the switching station.

Limitations:

The Contractor is to carry out the works taking full account of the limitations imposed by the existing sites and the requirement to maintain all existing supplies during the construction works. Any temporary works, structures, connections etc. necessary to achieve this requirement are to be included in the tender price.

The Tenderer shall be deemed to have visited the site, inspected, gathered data and verified details of the as built system in order to design, supply and interface their new equipment. All necessary materials, adjustments dismantling, remedial and tiding-up work in order to complete the work specified shall be included in the contract price. The Contractor is responsible for ensuring that all and/or any item(s) of work required for the safe, efficient and satisfactory completion and functioning of the works, are included in the bid price whether they be described in the specification or not.

PLANT REQUIREMENTS:

i) Outdoor switchyard
ii) Civil works:
iii) 33kV Incoming Feeder
iv) 33kV Outgoing Feeders
v) 33kV Single Phase Voltage Transformers
vi) 33kV Control Panels
vii) Energy Metering Panel
viii) 110V Battery and Battery Chargers
ix) LV AC / DC Panels
x) Earthing System
xi) Multi core Control and Power cables
xii) Training

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

TECHNICAL SPECIFICATIONS FOR SWICHING STATION

1. 33KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER (VCB)

Sl. No.	Description	Unit	Requirements
1	System voltage	kV	33
2	Rated voltage	KV	36
3	Rated frequency	HZ	50
4	Rated normal current		
	a) Incoming Feeder	A	N/A
	b) Outgoing Feeder	A	1250
5	Interrupting medium		Vacuum
6	Number of phases		3
7	Rated short-circuit breaking current	KA	31.5
8	Rated short-circuit making current	KA	78.75
9	First pole to clear factor		1.3
10	Rated operating sequence		O-0.3s-CO-3min-CO
11	Rated duration of short circuit	Sec	3
12	Impulse withstand on 1.2/50 μs wave	KV	170
13	Power frequency test voltage (dry) at 50Hz,1 min	KV	70
14	Circuit breaker operating mechanism type		Gang operated spring charged & manual
15	Operating particulars		
	a) Opening time: without current at 100% rated breaking current	ms (max)	0.05
	b) Breaking time	ms	<45ms
	c) Closing time	ms	70±10
16	Is the circuit breaker trip free?	Yes/No	Yes
17	Trip coil voltage	VDC	110
18	Rated supply voltage of shunt opening release	VDC	110
19	Spring charging motor voltage	VAC	415/230
20	Minimum clearance in air		
	a) Between phases	mm	430
	b) Phases to earth	mm	380
21	Degree of protection		IP 55

22	Auxiliary switch:		
	NO		9
	NC		9
23	Is lockout facility fitted		Yes
24	Rated breaking current :		
	Line charging	KA	25
	Cable charging	KA	50
	Small inductive	KA	02
25	Installation		Outdoor
26	Creepage Distance	mm/kv	25
27	Closing Coil	Nos.	01
28	Tripping Coil	Nos.	02
29	Standard		IEC 62271-100

2. 33KV DISCONNECTING SWITCH AND EARTHING SWITCH (DS/ES)

Sl. No.	Description	unit	Requirements
1	Installation		Outdoor
2	Mounting position		Vertical/Horizontal
3	Method of operation		Gang operated
4	Type of operating mechanism		Manual
5	System voltage	kV	33
6	Rated voltage	kV	36
7	Frequency	Hz	50
8	Number of pole	Nos.	3
9	Rated normal current-		
	a) Bus Sectionalizer	A	2000
	b) Incoming Feeder	A	N/A
	c) Outgoing Feeder	A	1250
10	Rated short time withstand current	kA rms	31.5
11	Rated duration of short circuit	sec	3
12	Rated peak withstand current	kA pk	110
13	Basic insulation level	kV	170
14	Power frequency withstand voltage (1min)	Kv	70
15	Creep age distance	mm	900
16	Material contact		Copper with silver / Nickel coating
17	Number of Auxiliary switch:		
	NO		9
	NC		9
18	Earthing blade		6

19	Degree of protection		IP 55
20	Type of breaks per pole		Single
21	Standard		IEC 62271-102

3. 33KV CURRENT TRANSFORMER (CT)

Sl. No.	Description	Unit	Requirements
1	Type		Electromagnetic induction, single phase, outdoor
2	Rated primary current		
	(a) Incoming Feeder (N/A)	Ams	2400-1600/5-5-5A
	(b) Outgoing Feeder	Ams	800-400/5-5-5A
3	Rated secondary current	Ams	5-5-5A
4	Rated secondary accuracy and burden		
	a) Metering (core 1- for indicating meters)		0.2, 30VA
	b) Metering (core 2- dedicated for energy metering)		0.2, 30VA
	c) Protection (core 3)		5P20, 30VA
5	Rated frequency	Hz	50
6	System voltage	kV	33
7	Rated voltage for equipment	kV	36
8	Short time current rating for 3 sec.	kA	31.5
9	Extended current rating (% of rated current)	%	120
10	Over current rating	A	10
11	Basic insulation level on 1.2 / 50 micro-sec wave	kV	170
12	Power frequency withstand voltage (1 min, 50 Hz)	kV	70
13	Creepage distance	mm/kv	25
14	Bushing		Porcelain outdoor type
15	System earthing		Effectively earthed
16	Insulation class		A
17	Standard		IEC 60044-1
18	Knee point voltage(at max ratio)		<150v for metering <600v for protection
*	**Remarks**	**CT ratio to be reviewed with PGCB / REB (if required)**	

4. 33KV VOLTAGE TRANSFORMER (VT FOR BUS & FEEDERS): If Applicable

Sl. No.	Description	Unit	Requirements
1	Type		Electromagnetic induction, single phase, outdoor
2	Rated primary voltage	kV	33/ √3
3	Rated voltage for secondary windings	kV	0.11 / √3 and 0.11 / √3
4	Rated secondary burden and accuracy		
	Secondary winding Core 1 (Dedicated for energy metering)	VA Class	60 0.2
	Secondary winding Core 2	VA Class	50 3P
5	Frequency	Hz	50
6	Impulse withstand voltage (1.2/50 micro sec wave)	kV	170
7	Cree page distance	mm/kV	25
8	System earthing		Effectively earthed
9	Power frequency withstand voltage (1min)	KV	70
10	Partial discharge	PC	≤5
11	Short circuit withstand voltage	KA	63
12	Rated voltage factor		1.2 continuous 1.9 30 second
13	Standard		IEC 60044-2

5. 33KV LIGHTNING ARRESTER (LA)

Sl. No.	Description	Unit	Requirement
1	Type		Metal Oxide, (ZnO) Gapless type, single phase
2	System voltage	kV	33
3	Rated voltage	kV	36
4	System frequency	Hz	50
5	Continuous operating voltage	kV	25 kV (rms)
6	Rated arrester voltage	kV	30
7	Standard nominal discharge current	kA	10
8	Reference current at ambient temperature	mA	2

9	Steep current impulse residual voltage	kV PK	84
10	Basic insulation level on 1.2 / 50 micro-sec wave	kV	170
11	Power frequency withstand voltage (1.2/50 ms)	kV	70
12	Lightning impulse residual voltage at 10kA	kV PK	75
13	Duty Class		Heavy Duty Station Class
14	Earthing system		Effectively earthed
15	Discharge class		3
16	Pressure relief class		Class A
17	Degree of Protection		IP 55
18	Surge Counter & Current Monitor		Yes
19	Standard		IEC 60099-4

6. 33/0.415KV, 100KVA AUXILIARY TRANSFORMER (N/A)

Sl. No.	Description	Unit	Requirement
1	Rated power	KVA	100
2	Type of cooling		ONAN
3	Coolant		Mineral Oil
4	Number of phase		3
5	Frequency	Hz	50
6	Normal transformation ratio	KV	33/0.4
7	Rated primary voltage	KV	33
8	Rated secondary voltage	kV	0.415
9	Nominal LT voltage	KV	0.415 /0.240
10	Highest system voltage of		
	a) Primary winding	kV	36
	b) Secondary winding	V	457
11	Basic insulation level	kV	170
12	Power frequency withstand voltage (1min)		
	a) HT side	kV	70
	b) LT side	kV	2.5
13	Type		Core
14	Insulation		Outdoor, tropical and high humidity
15	Earthing		Neutral earth at LT, 3-phase 4-wire
16	Windings		Double wound and of high conductivity copper

17	Vector Group		DYN ll
18	Neutral to be Brought out		
	a) HT		Nil
	b) LT		Yes
19	Neutral insulation		Full insulation and 100% capacity
20	LT bushing	Nos	4
21	Impedance voltage at 75 ^{o}C at normal ratio and rated capacity		5%
22	Tapping range		5 steps off-load tap changer, 2.5% per step
23	Type of tap changer		Manual
24	Maximum temperature rise over 40 ^{o}C ambient when transformer is working at full load and tap changer is at normal position		
	a) Winding by resistance	^{o}C	65
	b) Oil by temperature	^{o}C	60
25	Type of base		Ground mounted

7. 33KV BUSBARS AND CONNECTORS

Sl. No.	Description	Unit	Requirement
A.	**FLEXIBLE CONDUCTORS**		
1	Conductor/connector material		ACSR/ 2×Martin
2	Rated current (site rating)	A	2500
3	Temperature rise at rated current	^{o}C	35

8. 33KV BUSBAR INSULATOR STRING

Sl. No.	Description	Unit	Requirement
1	Insulator material		Porcelain
2	Number of units per string	nos.	4
3	Insulator voltage class		
4	Type of insulator		Ball and socket type disc, security clip made of rod brass alloy
5	Cree page/leakage distance (min)	mm	298
6	Total Cree page distance of string	mm	900

7	Unit spacing	mm	146
8	Dry arcing distance (min)	mm	1968
9	Diameter of insulator	mm	256
10	Withstand voltage (min)		
	a) Power frequency dry (one min)	kV	70
	b) Power frequency wet(one min)	kV	40
	c) Impulse 1.2 / 50 micro sec	kV	110
11	Flashover voltage (min)		
	a) Power frequency dry (one min)	kV	80
	b) Power frequency wet(one min)	kV	50
	c) 50% impulse 1.2 / 50 micro sec wave, positive or impulse 1.2 / 50 micro sec wave positive	kV	125
	d) 50% impulse 1.2 / 50 micro sec wave, negative	kV	130
12	Power frequency puncture voltage (min)	kV	110
13	Radio influence voltage data (min)		
	a) Power frequency test voltage rms to ground	kV	10
	b) Maximum RIV at 1000Kc	micro V	50
14	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
15	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
16	Insulator hardware		Insulator hardware for insulator strings or bus support insulator shall have UTS-120 KN and galvanized as per IEC-729

9. SHIELD WIRE, EARTHING GRID AND EARTHING ELECTRODE

Sl. No.	Description	Unit	Requirement
A.	**Shield Wires**		
1	Material		High strength steel
2	Grade of steel	kg.	4
3	Number of strands	nos.	7
4	Diameter of each strand	mm	3.25
5	Overall diameter	mm	9.8
6	Nominal cross section	mm^2	35
7	Weight per km length	kg	460
8	Rated ultimate tensile strength	kg	4900
9	Class of Zinc coating		Class-A
B	**Earth Grid**		
1	Material		Copper
2	Maximum earth fault current for 3 sec	kA	31.5
C	**Earth Electrodes**		
1	Material		Copper
2	Diameter	mm	16
3	Calculated resistance of combined earth grid	Ohm	Less than 0.5

10. BATTERIES AND CHARGER

Sl. N0.	Description	Unit	Requirements
A.	**BATTERY**		
1	Electrolyte type		Nickel Cadmium / Alkaline
2	Nominal voltage	V/per cell	1.2
3	Capacity at 5 hour rate	Ah	250
4	Number of cells	nos.	92
5	Operating voltage	VDC	110
6	Continuous discharge current at the rate of 10 hour and final cell voltage 1.1 volt	Amp	10
7	Short time discharge current at the rate of 2 hour and final cell voltage 1.1 volt	Amp	50
8	Discharge voltage	V	1.0 – 1.4 per cell
9	Charging voltage (normal)	V	1.4-1.5Volt per cell
10	Charging voltage (Maximum)	V	1.54-1.69 per cell
11	Battery voltage at end of the duty cycle	V	1.1Volt per cell

B.	**CHARGER**		
1	Rectifier Type		(Thyristor Controlled) Silicon or Selenium
2	AC input voltage	V	415V±15%, 3 phase
3	Input a.c frequency	HZ	50±5%
4	DC output voltage range	V DC	110±10%
	a) normal charge	V DC	110±10%
	b) Float charge	V DC	1.42 volt per cell 110±5%
	c) Boast charge	V DC	1.55 volt per cell
5	Installation breakdown voltage	kV	2kV for 1 minute
6	Output Current (continuous)	A DC	50
7	Type of AVR		DVR-Diode Voltage Regulator
8	Installation		Indoor
9	Charging Mode:		Both constant current & constant Voltage

11. LV AC DC DISTRIBUTION BOARD (N/A)

Sl. No.	Description	Unit	Requirement
A.	**AC DISTRIBUTION BOARD**		
1	Bus bar rating (R, Y, B, N, G)	Amps	600
2	Voltage	Volts	415
3	Incoming breaker rating (MCCB)	Amps	400
B.	**D.C. DISTRIBUTION BOARD**		
1	Bus bars:- (+VE,-VE, G)		
	a) Maximum current rating	A DC	200
	b) Voltage rating	V DC	110
C.	Two distribution bus shall be maintained in each pannel (AC & DC Distribution) and both shall be electricity interlocked.		

12. 33KV CONTROL, METERING AND RELAY PANEL

Sl.No.	Description	Unit	Requirement
A.	**33KV CONTROL PANEL**		
1	Number of control panelsKVRH Meter Panel	Nos	1
2	Number of KWH Metering Panel	No.	1
A1.	**PROTECTION**		
A.1.1	**IDMT OVER CURRENT & EARTH FAULT RELAYS**		
1	Manufacturer's Name & Country		Siemens (Germany)/ Alstom (UK/France)/ ABB (Switzerland/Sweden)/ Schneider (France)
2	Type of relay		Numerical Programmable
3	Range of current setting		
	a) Phase element	% of CT rating	
	b) Earth fault element	% of CT rating	
4	Range of timing settings at 10 time CT rating	Sec	
5	Burden of relay at 10 time CT rating	VA	
6	Percentage of current setting at which relay will reset	%	
7	Reset time after removal of 10 times CT rated current for:		
	a) Phase element (100%)	Sec	
	b) E/F element (40%)	Sec	
A2.	**METERING AND INDICATION**		
A.2.1	**KWH METER**		
1	Manufacturer's Name & Country		Siemens(Germany/Switzerland)/Alstom,(UK)/ABB(Switzerland)/AEG(Germany)/Schlumberger(USA)
2	Type of Meter		Numerical Programmable multifunction(3 element 4-wire)
3	Number of KWH Meters	Nos.	02 nos. with provision for 04 meters in the Metering panel
A.2.2	**INDICATION METERS (VOLT, AMPERE, KW, KVAR, PF)**		
1	Manufacturer		Siemens(Germany/Switzerland)/Alstom,(UK)/AB

			B(Switzerland)/AEG(Germany)/Schlumberger (USA)
2	Type of Meter		Digital /Analog
3	Type of Meters in each Panel		Volt, 3 nos. Amp, kW, kVAR and Pf

13. STEEL STRUCTURE DESIGN

Sl. N0.	Description	Unit	Requirements
1	Maximum ratio slenderness		
	a) Main members	mm	120
	b) Bracings	mm	180
	c) Redundant	mm.	250
2	Minimum size of member	mm	45×45×5
3	Min member thickness		
	Main member	mm	6
	Other bracing member	mm	5
	Plate	mm	5
	Bolt diameter	mm	16
4	Galvanizing thickness	mm	85

14. Control cable

XLPE insulated multi core control cable Laid up beded with PVC or tap. Flat/round wire armoring with helical steel taping and PVC sheathed, rated voltage 600/1000, continuous permissible voltage 720/1200 volts (VDE 027/3.69 BDS 901:85) (NYRGby) suitable for use in indoors, outdoors, underground and in water for continuous permissible service voltage of 720/1200 volts. Maximum resistance 4.73 ohm/km at 35°C.

15. **POWER CABLES**

15.1. **33 KV POWER CABLES (U/G)**

Guaranteed Technical Data Schedule of 33KV, 1-Core × 500 Sq.mm U/G XLPE Copper Cable

SL No.	Description	Unit	Required Specification
1	Name and address of the Manufacturer		To be mentioned
2	Type/Model of the offered cable		To be mentioned
3	Nominal system voltage	KV	33
4	Rated voltage of cable	KV	18/30(36)
5	Process of manufacturing		VCV/CCV
6	Number of core and cross sectional area of conductor cores	Sq.mm	1×500
7	Conductor material		Copper
8	Minimum no of strand	No.	53
9	Diameter of each strand	mm	To be mentioned
10	Shape of conductor		Compacted Circular
11	Type of conductor screen		Semi-conducting
12	Thickness of semi conducting screen	mm	0.6
13	Avg. thickness of insulation	mm	8.0
14	Process of curing		Dry process
15	Material of insulation		Cross Linked Polyethylene (XLPE)
16	Type of non metallic insulating screen		Semi-conducting
17	Thickness of semi conducting insulation screen	mm	1.0
18	Number and diameter of copper screen strands	No./mm	Based on design calculation
19	Composition of filler		PVC
20	Composition of bedding		Extruded PVC
21	Thickness of bedding	mm	Based on design calculation
22	Number and diameter of armour wire	No./mm	As per IEC 60502
23	Avg. thickness of MDPE over sheath	mm	Based on design calculation
24	Nominal diameter of complete cable	mm	Based on design calculation
25	Nominal weight per meter of complete cable	Kg/m	Based on design calculation
26	Minimum radius of bend round which cable can be laid	mm	Based on design calculation
27	Max. D.C resistance of conductor per meter at 20°C	Ohm/m	Based on design calculation
28	Max. A.C resistance of conductor per meter at MAXIMUM CONDUCTOR TEMPARATURE	Ohm/m	Based on design calculation
29	Star resistance per meter of cable	Ohm/m	Based on design calculation

	at 50Hz		
30	Star capacitance per per meter of cable at 50Hz	pF/m	Based on design calculation
31	Charging current per conductor per meter at 18000/30000 Volts , 50Hz	mA	Based on design calculation
32	Maximum current carrying capacity of conductor in ground	A	Based on design calculation
33	Maximum conductor temperature under continuous loading	℃	Based on design calculation
34	Short circuit withstand capacity nof the cable for 1 sec. duration	KA	Min. 25
35	conductor temperature at the end of short circuit	℃	≤250
36	Earth fault withstand capacity for 1 sec.	KA	Min. 25
37	Screen short circuit withstand capacity	KA	Min. 25
38	Armour short circuit capacity	KA	Based on design calculation
39	Cable resistance, reactance		
	a) for positive sequence	Ohm/m	Based on design calculation
	b) negative sequence	Ohm/m	Based on design calculation
	c) Zero sequence	Ohm/m	Based on design calculation

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE B

TENDER PRICES

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE B

TENDER PRICES

The Tenderer is to complete in full the following Price Schedule in accordance with BOQ described in section-6 **of this Tender Document.**

Each item is to be priced separately for switching station & 33KV Line Augmentation work and is to be fully inclusive of all costs associated with completing the Works. The prices are to include for surveying, design, fabrication, manufacture, assembly, quality control, testing, packing, insurance, delivery to site. The estimated cost of elements are to be shown in the appropriate column in the schedule shall include landing, haulage, transport to site, civil works, erection, construction, assembly, connecting, testing finishing of, setting to work and maintenance during the defect liability period including all supervision, project management costs, overheads, on-costs and profits etc.

The Works shall be valued and paid exclusively at the unit prices and total prices quoted in the schedule, which are to remain fixed for the duration of the Contract.

The prices quoted are to be firm for the completed Works in full working order in accordance with the requirements of the Contract.

Prices for the equipment at site, erection/ supervision elements are to be quoted in Bangladesh Taka inclusive of all duties and taxes paid or payable on components and material incorporated or to be incorporated in the plant.

Prices shall also include for all necessary local materials, inland transportation, insurance etc.

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

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SCHEDULE C

BAR CHART PROGRAMME OF KEY ACTIVITIES

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE C

BAR CHART PROGRAMME OF KEY ACTIVITIES

The individual dates are all contractually bindings.

The times given under column C are the commissioning target dates at present planned to be achieved and may be the subject of mutual adjustment.

The times entered under column A are to be the dates guaranteed for arrival at site of the equipment before plant erection to the extent necessary to enable him to proceed with work to meet the dates under column B guaranteed for complete delivery, erection and commissioning.

The time include all necessary control, relay, metering, auxiliary power, ancillary equipment to enable the respective item of plant to be completely commissioned and put into commercial operation together with such other associated equipment, e.g. bus-bars etc. as will ensure that subsequent shutdown are unnecessary for at least only of a temporary or short time nature.

List of Equipment	A* Guaranteed Arrival at site	B* Guaranteed Completion	C* Target Completion

* Time in months, after signing of Contract.

Preliminary foundation drawings as called for in the Technical Specification shall be provided within 1.0 month of the contract commencing date.

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

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TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE D

MANUFACTURERS, PLACES OF MANUFACTURE AND TESTING

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE D

MANUFACTURERS, PLACES OF MANUFACTURE AND TESTING

Item	Description	Manufacturer	Place of Manufacture	Place of Testing and Inspection
1.	33KV SWITCHGEAR Circuit Breakers (VCB) Operating Mechanism Disconnecting Switch (DS) Earthing Switch (ES) Busbar Connector Lightning Arrester (LA) Voltage Transformer (VT) Current Transformer (CT) Insulator Disc Insulator Post Type DO Fuse Remote Control Panel			

	Relays Indicating Instrument Energy Meters Battery Charger Battery LVAC Panel DC Panel LV Power & Control Cables			
2.	STEEL STRUCTURES			
3.	EARTHING Copper Conductor			
4.	SITE ERECTION AND COMMISSIONING BY			
5.	CIVIL WORKS Design to be performed by: Construction by:			
6.	All materials for Augmentation of 33 KV existing line.			

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

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SCHEDULE E

TECHNICAL PARTICULARS AND GUARRANTEES

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE E

TECHNICAL PARTICULARS AND GUARRANTEES

1.0 33KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER (VCB)

1.1 33KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER (FEEDER BREAKER)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Number of phases		3	
4	No. of break per phase		To be mentioned	
5	Interrupting medium		Vacuum	
6	Vacuum interrupter's manufacturer		To be mentioned	
7	Rated voltage	KV	33	
8	Maximum voltage	KV	36	
9	Rated frequency	HZ	50	
10	Rated normal current for outgoing feeder	A	1250	
11	Rated breaking currents:	Arms		
	a) Line charging	A	25	
	b) Cable charging	A	50	
	c) Small inductive	A	02	
12	Rated short-circuit breaking current	KA rms	31.5	
13	First pole to clear factor		To be mentioned	
14	Rated transient recovery voltage at 100% rated short circuit breaking current	KV	To be mentioned	
15	Rated short-circuit making current	KA	78.75	
16	Rated operating sequence		O-0.3s-CO-3min-C	
17	Rated duration of short-circuit	S	3	
18	Rated out of phase breaking current	KA	To be mentioned	
19	Rated opening time	ms	To be mentioned	
20	Rated break time	ms	To be mentioned	
21	Rated closing time	ms	To be mentioned	
22	Is circuit breaker re-strike free	Yes/no	Yes	
23	Rated short time withstand current, 3 sec rms	KA	31.5	
24	Impulse withstand on 1.2/50μs wave	kV	170	
25	Power frequency test voltage (dry) at 50Hz 1 min	kV	70	
26	Type of arc contacts or arc control device		To be mentioned	

27	Main contact			
	a) Type of contact		To be mentioned	
	b) Material of contact surfaces		To be mentioned	
	c) Contact resistance	μΩ	Less than 40	
28	Length of break	mm	To be mentioned	
29	Length of stroke	mm	To be mentioned	
30	Operating mechanism manufacturer		To be mentioned	
31	Operating mechanism type		Spring	
32	Trip free/or fixed trip		Trip free	
33	Is lockout facility fitted?		Yes	
35	Closing supply			
	a) Closing coil Volts	V DC	110V	
	b) Closing coil current	A DC	To be mentioned	
36	Rated supply voltage of shunt opening release			
	a) Trip coil Volts	V DC	110V	
	b) Trip coil current	A DC	To be mentioned	
37	Spring charging motor			
	a) Current	A AC	To be mentioned	
	b) Voltage AC	V AC	415/230	
38	Number of auxiliary switch contacts			
	a) normally open	NO	9	
	b) normally closed	NC	9	
	c) adjustable		As required	
39	Maximum creepage			
	a) to earth	mm	To be mentioned	
	b) across interrupter terminals	mm	To be mentioned	
40	Number of interrupters per pole	Nos	1	
41	Material of interrupter chamber		To be mentioned	
42	Wall thickness of interrupter chamber	mm	To be mentioned	
	a) Material of contact surface primary arcing		To be mentioned	
	b) Contact resistance		To be mentioned	
43	Length of each break	mm	To be mentioned	
44	Length of stroke	mm	To be mentioned	
45	Operating rod for moving contact(s) material		To be mentioned	
46	Dimensions etc.		To be mentioned	
47	Weight of circuit breaker unit complete	kg	To be mentioned	
48	Maximum shock load imposed on floor or foundations when opening under fault conditions (state whether tension or compression)	N	To be mentioned	
49	Period of time equipment has been in commercial operation		To be mentioned	
50	Opening time			
	a) Without current at 100% of rated breaking current	sec	0.5 max	
	b) Breaking time	cycle	5 (0.1 second)	
	c) Closing time	ms	70±10	
51	Maximum arc duration at any duty cycle of IEC 56-2	ms at.....%	To be mentioned	
52	Current at which maximum arc duration occurs (critical current)	A	To be mentioned	
53	Make time	ms	To be mentioned	
54	Time from closing of control switch to completion of closing stroke during fault making	ms	To be mentioned	
55	Is an external series break incorporated in the breaker?	Yes/no	To be mentioned	
56	Is any device used to limit transient recovery voltage?	Yes/no	To be mentioned	
57	Number of close/trip operation possible on one spring charge	Nos.	To be mentioned	
Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
58	Minimum clearance in air:			
	a) between phases	mm	430	
	b) phase to earth	mm	380	

	c) across interrupters	mm	To be mentioned	
	d) live parts to ground level	mm	To be mentioned	
59	Period of time the equipment has been in commercial operation	Years	To be mentioned	
60	Cree page distance (min)	kV/mm	25	
61	Method of indicating VCB ON/OFF	Mech/Elect	To be mentioned	
62	Life of interrupter	Years	To be mentioned	
63	Pressure in vacuum tube for VCB	Bar	To be mentioned	
64	Guaranteed numbers of operation for vacuum interrupter			
	a) at rated crrent switching	Nos.	To be mentioned	
	b) at short circuit current switching	Nos.	To be mentioned	
65	All current carrying parts of VCB shall be made of		Copper	
66	Standard		IEC 56	
67	Degree of Protection		IP 55	

1.2 33KV OUTDOOR TYPE VACUUM CIRCUIT BREAKER (BUS COUPLER BREAKER) (N/A)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Number of phases		3	
4	No. of break per phase		To be mentioned	
5	Interrupting medium		Vacuum	
6	Vacuum interrupter's manufacturer		To be mentioned	
7	Rated voltage	KV	33	
8	Maximum voltage	KV	36	
9	Rated frequency	HZ	50	
10	Rated normal current-feeder	A	1250	
11	Rated breaking currents:	Arms		
	a) Line charging	A	25	
	b) Cable charging	A	50	
	c) Small inductive	A	02	
12	Rated short-circuit breaking current	KA rms	31.5	
13	First pole to clear factor		To be mentioned	
14	Rated transient recovery voltage at 100% rated short circuit breaking current	KV	To be mentioned	
15	Rated short-circuit making current	KA	78.75	
16	Rated operating sequence		O-0.3s-CO-3min-C	
17	Rated duration of short-circuit	S	3	
18	Rated out of phase breaking current	KA	To be mentioned	
19	Rated opening time	ms	To be mentioned	
20	Rated break time	ms	To be mentioned	
21	Rated closing time	ms	To be mentioned	
22	Is circuit breaker re-strike free	Yes/no	Yes	
23	Rated short time withstand current, 3 sec rms	KA	31.5	
24	Impulse withstand on 1.2/50µs wave	kV	170	
25	Power frequency test voltage (dry) at 50Hz 1 min	kV	70	
Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
26	Type of arc contacts or arc control device		To be mentioned	
27	Main contact			
	a) Type of contact		To be mentioned	
	b) Material of contact surfaces		To be mentioned	

	c) Contact resistance	μΩ	Less than 40	
28	Length of break	mm	To be mentioned	
Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
29	Length of stroke	mm	To be mentioned	
30	Operating mechanism manufacturer		To be mentioned	
31	Operating mechanism type		Spring	
32	Trip free/or fixed trip		Trip free	
33	Is lockout facility fitted?		Yes	
35	Closing supply			
	a) Closing coil Volts	V DC	110V	
	b) Closing coil current	A DC	To be mentioned	
36	Rated supply voltage of shunt opening release			
	a) Trip coil Volts	V DC	110V	
	b) Trip coil current	A DC	To be mentioned	
37	Spring charging motor			
	a) Current	A AC	To be mentioned	
	b) Voltage AC	V AC	415/230	
38	Number of auxiliary switch contacts			
	a) normally open	NO	9	
	b) normally closed	NC	9	
	c) adjustable		As required	
39	Maximum cree page			
	a) to earth	mm	To be mentioned	
	b) across interrupter terminals	mm	To be mentioned	
40	Number of interrupters per pole	Nos	1	
41	Material of interrupter chamber		To be mentioned	
42	Wall thickness of interrupter chamber	mm	To be mentioned	
	a) Material of contact surface primary arcing		To be mentioned	
	b) Contact resistance		To be mentioned	
43	Length of each break	mm	To be mentioned	
44	Length of stroke	mm	To be mentioned	
45	Operating rod for moving contact(s) material		To be mentioned	
46	Dimensions etc.		To be mentioned	
47	Weight of circuit breaker unit complete	kg	To be mentioned	
48	Maximum shock load imposed on floor or foundations when opening under fault conditions (state whether tension or compression)	N	To be mentioned	
49	Period of time equipment has been in commercial operation		To be mentioned	
50	Opening time			
	a) Without current at 100% of rated breaking current	sec	0.5 max	
	b) Breaking time	cycle	5 (0.1 second)	
	c) Closing time	ms	70±10	
51	Maximum arc duration at any duty cycle of IEC 56-2	ms at.....%	To be mentioned	
52	Current at which maximum arc duration occurs (critical current)	A	To be mentioned	
53	Make time	ms	To be mentioned	
54	Time from closing of control switch to completion of closing stroke during fault making	ms	To be mentioned	
55	Is an external series break incorporated in the breaker?	Yes/no	To be mentioned	
56	Is any device used to limit transient recovery voltage?	Yes/no	To be mentioned	
57	Number of close/trip operation possible on one spring charge	Nos.	To be mentioned	
58	Minimum clearance in air:			
	a) between phases	mm	430	
	b) phase to earth	mm	380	

	c) across interrupters	mm	To be mentioned	
	d) live parts to ground level	mm	To be mentioned	
59	Period of time the equipment has been in commercial operation	Years	To be mentioned	
Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
60	Cree page distance (min)	kV/mm	25	
61	Method of indicating VCB ON/OFF	Mech/Elect	To be mentioned	
62	Life of interrupter	Years	To be mentioned	
63	Pressure in vacuum tube for VCB	Bar	To be mentioned	
64	Guaranteed numbers of operation for vacuum interrupter			
	a) at rated crrent switching	Nos.	To be mentioned	
	b) at short circuit current switching	Nos.	To be mentioned	
65	All current carrying parts of VCB shall be made of		Copper	
66	Standard		IEC 56	
67	Degree of Protection		IP 55	

2. 33KV DISCONNECTING SWITCH AND EARTHING SWITCH (DS/ES)

2.1. 33KV DISCONNECTING SWITCH (AT BUS SIDE FOR INCOMING) (If applicable)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Operating system		Vertical	
4	System voltage	kV	33	
5	Rated voltage	kV	36	
6	Frequency	Hz	50	
7	Number of pole	Nos.	3	
8	Rated normal current	A	2000	
9	Rated short time withstand current for 3 sec	kA rms	31.5	
10	Rated duration of short circuit	Sec	3	
11	Rated peak withstand current	kA pk	78.75	
12	Basic insulation level	kV	170	
13	Installation		Outdoor	
14	Type		Air	
15	Construction		Open	
16	Method of operation		Gang operated,	
17	Type of operating mechanism		Manual	
18	Mounting position		Vertical	
19	Type of contact		To be mentioned	
20	Materiall of contact service		To be mentioned	
21	Manual operating torque	KNm	To be mentioned	
22	Load switching capability	A	To be mentioned	
23	Mechanical Terminal Load	N	To be mentioned	
24	Insulation Cree page	mm	To be mentioned	
25	Number of auxiliary switches			
	a) normally open	NO	9	
	b) normally closed	NC	9	
	c) adjustable		As required	
26	Other auxiliary loads			
	a) voltage	V DC	110	

	b) current	A DC	To be mentioned	
27	Total weight of three pole dis-connector complete	.Kg	To be mentioned	
28	Period of time equipment has been in commercial operation	Yr	To be mentioned	
29	Line charging current breaking capacity	A	To be mentioned	
30	Magnetizing current breaking capacity	A	To be mentioned	
31	Standard		IEC-129	
32	Degree of Protection		IP 55	
33	Power frequency with stand voltage	Kv	70	
34	Creepage Distance	mm	900	
35	Material Contact		Copper with Silver Coating	

2.2. 33KV DISCONNECTING SWITCH (BUS SECTION)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Operating system		Vertical	
4	System voltage	kV	33	
5	Rated voltage	kV	36	
6	Frequency	Hz	50	
7	Number of pole	Nos.	3	
8	Rated normal current	A	2500	
9	Rated short time withstand current for 3 sec	kA rms	31.5	
10	Rated duration of short circuit	Sec	3	
11	Rated peak withstand current	kA pk	78.75	
12	Basic insulation level	kV	170	
13	Installation		Outdoor	
14	Type		Air	
15	Construction		Open	
16	Method of operation		Gang operated,	
17	Type of operating mechanism		Manual	
18	Mounting position		Vertical	
19	Type of contact		To be mentioned	
20	Materiall of contact service		To be mentioned	
21	Manual operating torque	KNm	To be mentioned	
22	Load switching capability	A	To be mentioned	
23	Mechanical Terminal Load	N	To be mentioned	
24	Insulation Cree page	mm	To be mentioned	
25	Number of auxiliary switches			
	a) normally open	NO	9	
	b) normally closed	NC	9	
	c) adjustable		As required	
26	Other auxiliary loads			
	a) voltage	V DC	110	
	b) current	A DC	To be mentioned	
27	Total weight of three pole dis-connector complete	.Kg	To be mentioned	
28	Period of time equipment has been in commercial operation	Yr	To be mentioned	
29	Line charging current breaking capacity	A	To be mentioned	
30	Magnetizing current breaking capacity	A	To be mentioned	
31	Standard		IEC-129	
32	Degree of Protection		IP 55	

33	Power frequency with stand voltage	Kv	70	
34	Creepage Distance		900	
35	Material Contact		Copper with Silver Coating	

2.3. 33KV DISCONNECTING SWITCH (FOR FEEDERS AT BUS SIDE)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Operating system		Vertical	
4	System voltage	kV	33	
5	Rated voltage	kV	36	
6	Frequency	Hz	50	
7	Number of pole	Nos.	3	
8	Rated normal current	A	1250	
9	Rated short time withstand current for 3 sec	kA rms	31.5	
10	Rated duration of short circuit	Sec	3	
11	Rated peak withstand current	kA pk	78.75	
12	Basic insulation level	kV	170	
13	Installation		Outdoor	
14	Type		Air	
15	Construction		Open	
16	Method of operation		Gang operated,	
17	Type of operating mechanism		Manual	
18	Mounting position		Vertical	
19	Type of contact		To be mentioned	
20	Materiall of contact service		To be mentioned	
21	Manual operating torque	KNm	To be mentioned	
22	Load switching capability	A	To be mentioned	
23	Mechanical Terminal Load	N	To be mentioned	
24	Insulation Cree page	mm	To be mentioned	
25	Number of auxiliary switches			
	a) normally open	NO	9	
	b) normally closed	NC	9	
	c) adjustable		As required	
	d) Earting blade		6	
26	Other auxiliary loads			
	a) voltage	V DC	110	
	b) current	A DC	To be mentioned	
27	Total weight of three pole dis-connector complete	.Kg	To be mentioned	
28	Period of time equipment has been in commercial operation	Yr	To be mentioned	
29	Line charging current breaking capacity	A	To be mentioned	
30	Magnetizing current breaking capacity	A	To be mentioned	
31	Standard		IEC-129	
32	Degree of Protection		IP 55	
33	Power frequency with stand voltage	Kv	70	
34	Creepage Distance		900	
35	Material Contact		Copper with Silver Coating	

2.4. 33KV DISCONNECTING SWITCH AND EARTHING SWITCH (FEEDER SIDE)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Operating system		Vertical	
4	System voltage	kV	33	
5	Rated voltage	kV	36	
6	Frequency	Hz	50	
7	Number of pole	Nos.	3	
8	Rated normal current	A	1250	
9	Rated short time withstand current for 3 sec	kA rms	31.5	
10	Rated duration of short circuit	Sec	3	
11	Rated peak withstand current	kA pk	78.75	
12	Basic insulation level	kV	170	
13	Installation		Outdoor	
14	Type		Air	
15	Construction		Open	
16	Method of operation		Gang operated,	
17	Type of operating mechanism		Manual	
18	Mounting position		Vertical	
19	Type of contact		To be mentioned	
20	Materiall of contact service		To be mentioned	
21	Manual operating torque	KNm	To be mentioned	
22	Load switching capability	A	To be mentioned	
23	Mechanical Terminal Load	N	To be mentioned	
24	Insulation Cree page	mm	To be mentioned	
25	Number of auxiliary switches			
	a) normally open	NO	9	
	b) normally closed	NC	9	
	c) adjustable		As required	
	d) Earthing blade		6	
26	Other auxiliary loads			
	a) voltage	V DC	110	
	b) current	A DC	To be mentioned	
27	Total weight of three pole dis-connector complete	.Kg	To be mentioned	
28	Period of time equipment has been in commercial operation	Yr	To be mentioned	
29	Line charging current breaking capacity	A	To be mentioned	
30	Magnetizing current breaking capacity	A	To be mentioned	
31	Standard		IEC-129	
32	Degree of Protection		IP 55	
33	Power frequency with stand voltage	Kv	70	
34	Creepage Distance		900	
35	Material Contact		Copper with Silver Coating	

3. 33KV CURRENT TRANSFORMER (CT)

3.1 33KV CURRENT TRANSFORMER (BUS COUPLER) (If applicable)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Standard		IEC 185 or equivalent	
4	Installation		Outdoor type mounted on galvanized steel structure	
5	Type		Electromagnetic induction, single phase, outdoor, oil/ Synthetic	
6	Bushing		Porcelain	
7	Major insulation		Low oil content outdoor type	
8	Application		Protection/ metering	
9	Rated secondary accuracy and burden			
	a) Metering (core 1- for indicating metering)		0.2, 50VA	
	b) Metering (core 2- for energy metering)		0.2, 50VA	
	c) Protection (core 3)		5P20, 50VA	
10	Rated primary current	Arms	2400-1600/5-5-5A	
11	Rated secondary current	Arms	5-5-5A	
12	Extended current rating	%	120	
13	Over current rating	A	10	
13	Short time current rating	kA	25 for 3 sec	
14	No of core		3	
15	System voltage	kV	33	
16	Rated voltage	kV	36	
17	Rated frequency	Hz	50	
18	Basic insulation level on 1.2 / 50 micro sec wave	kV	170	
19	Power frequency withstand voltage (1 min, 50Hz)	kV	70	
20	Insulator cree page (phase to earth)	mm/kV	25	
21	Rated dynamic current	kA pk	100	
22	Insulation class		A	
23	Is earth screen fitted between primary and secondary windings		Yes	
24	Extended Current Rating (% of rated current)	%	120	
25	Over Current Rating	A	10	
26	Knee point voltage	V	To be mentioned	
27	System earthing		Effectively earthed	
28	Standard	-	As per relevant IEC-185	

3.2 33KV CURRENT TRANSFORMER (FEEDER)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Standard		IEC 185 or equivalent	
4	Installation		Outdoor type mounted on galvanized steel structure	
5	Type		Electromagnetic induction, single phase, outdoor, oil/ Synthetic	
6	Bushing		Porcelain	
7	Major insulation		Low oil content outdoor type	
8	Application		Protection/ metering	
9	Rated secondary accuracy and burden			
	a) Metering (core 1)		0.2, 30VA	
	b) Protection (core 2)		5P20, 30VA	
10	Rated primary current	Amps	800-400/5-5-5A	
11	Rated secondary current	Amps	5-5-5A	
12	Extended current rating	%	120	
13	Over current rating	A	10	
13	Short time current rating	kA	31.5 for 3 sec	
14	No of core		3	
15	System voltage	kV	33	
16	Rated voltage	kV	36	
17	Rated frequency	Hz	50	
18	Basic insulation level on 1.2 / 50 micro sec wave	kV	170	
19	Power frequency withstand voltage (1 min, 50Hz)	kV	70	
20	Insulator cree page (phase to earth)	mm/kV	25	
21	Rated dynamic current	kA pk	100	
22	Insulation class		A	
23	Is earth screen fitted between primary and secondary windings		Yes	
24	Extended Current Rating (% of rated current)	%	120	
25	Over Current Rating	A	10	
26	Knee point voltage	V	To be mentioned	
27	System earthing		Effectively earthed	
28	Standard	-	As per relevant IEC-185	

4. 33KV VOLTAGE TRANSFORMER (VT FOR BUS)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacture		To be mentioned	
2	Model number		To be mentioned	
3	Installation		Outdoor type mounted on galvanized steel structure	
4	Type		Electromagnetic induction, single phase, outdoor, Oil	
5	Bushing		Porcelain	
6	Application		Protection and metering	
7	Major insulation		Low oil content	
8	System voltage	kV	33	
9	Rated voltage	kV	36	
10	Frequency	Hz	50	
11	Transformation ratio	kV	33/√3: 0.11/√3: 0.11 /√3	
12	Type of secondary		Double winding	
13	Rated secondary burden and accuracy			
	a) Secondary winding Core 1 (Dedicated for energy metering)	VA Class	60 0.2	
	(a) Secondary winding Core 2	VA Class	50 3P	
14	Total capacitance at 100 Hz	PF	To be mentioned	
15	50 Hz 1(one) minute withstand voltage wet	kV	To be mentioned	
16	Impulse withstand voltage (1.2 / 50 micro sec wave)	kV (min)	170	
17	Temperature co-efficient of ratio per ºC		To be mentioned	
18	Total external cree page distance	mm/kV	25	
19	Maximum errors with 5% primary voltage			
	a) Ratio	%	To be mentioned	
	b) Phase angle	minutes	To be mentioned	
20	Total install weight	kg	To be mentioned	
21	System earthing		Effectively earthed	
22	Standard		IEC 186 or equivalent	
23	Power frequency with stand voltage	Kv	70	
24	Partial Discharge	PC	≤5	
25	Short circuit withstand voltage	KA	63	
26	Rated voltage factor	1.2continuous 1.9 30 second		

5. 33KV LIGHTNING ARRESTER (LA)

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model Number		To be mentioned	
3	Type		Metal Oxide (Zno) single phase, Gapless type,	
4	System voltage	kV	33	
5	Rated voltage	kV	36	
6	Frequency	Hz	50	
7	Continuous operating voltage	kV	24	
8	Rated arrester voltage	kV	30	
9	Standard nominal discharge current	kA	10	
10	Reference current at ambient temperature	mA	2	
11	Steep current impulse residual voltage	kV pk	84	
12	Basic insulation level on 1.2 / 50 micro sec wave	kV	170	
13	Power frequency withstand voltage of housing Dry : Wet : Impulse :	 KVrms KVrms KV	 70 70 170	
14	Power frequency withstand voltage (1.2/50 ms)	kV	70	
15	Lightning impulse residual voltage (8/20 micro sec front time)	kVpk	100	
16	Step current impulse residual voltage at 10kA of 1 micro sec front time	kV pk	110	
17	High current impulse withstand value (4/10 micro sec)	kA	100	
18	Duty Class		Heavy	
19	Nominal diameter of resistor blocks	mm		
20	Pressure relief device fitted?		Yes/no	
21	Temporary over voltage capability			
	a) 0.1 sec		To be mentioned	
	b) 1.0 sec		To be mentioned	
	c) 10.0 sec		To be mentioned	
	d) 100.0 sec		To be mentioned	
22	Leakage current at rated voltage		To be mentioned	
23	Minimum reset voltage		To be mentioned	
24	Overall height of arrester (without supporting structure)	m	To be mentioned	
25	Clearances: Phase to earth (from centre line) Phase to phase (centre line to centre line)	 mm mm	 To be mentioned To be mentioned	
26	Overall weight of arrester (without supporting structure)	kg	To be mentioned	
27	Minimum creepage distance over insulator housing	mm/kV	To be mentioned	
28	Type & Description of surge monitoring device			
29	Over all dimension i) Height ii) Diameter	 mm mm	 To be mentioned To be mentioned	
30	Connecting lead from LA terminal to surge monitor		16 mm^2 insulated cu cable	
31	Neutral connection	-	Effectively Earthed	
32	Surge monitor		Shall be provided	
33	Standard		IEC 99-4	
34	Discharge Class		3	
35	Pressure relief class		Class A	
36	Degree of protection		IP 55	

6. 33/0.415KV, 200KVA AUXILIARY TRANSFORMER

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Model Number		To be mentioned	
3	Standard		IEC-76	
4	Rated power	KVA	200	
5	Type of cooling		ONAN	
6	Coolant		Mineral Oil	
7	Number of phase		3	
8	Frequency	Hz	50	
9	Normal transformation ratio	KV	33/0.4	
10	Nominal HT voltage	KV	33	
11	Maximum HT voltage	KV	36	
12	Nominal LT voltage	KV	0.415 /0.240	
13	Maximum LT voltage	KV	0.457	
14	Type		Core	
15	Insulation		Outdoor, tropical and high humidity	
16	Earthing		Neutral earth at LT, 3-phase 4-wire	
17	Windings		Double wound and of high conductivity copper	
18	No-load loss, Watts	W	To be mentioned	
19	Load losses at rated full load at 75^0C, Watts	W	To be mentioned	
20	Magnetising current at normal voltage, Amps	A	To be mentioned	
21	Test Voltage:			
	a) Impulse Test voltage 1.2/50 μs i) H.T ii) L.T	 KV KV	 170 10	
	b) Power frequency withstand voltage for 1 minute i) HT ii) L.T	 KV KV	 70 2.5	
22	Vector Group		Dynll	
23	Neutral to be Brought out			
	a) HT		Nil	
	b) LT		Yes	
24	Neutral insulation		Full insulation and 100% capacity	
25	LT bushing	Nos	4	
26	Impedance voltage at 75 ^{o}C at normal ratio and rated capacity		About 5%	
27	Tapping range		5 steps off-load tap changer, 2.5% in each step	
28	Type of tap changer		Manual	

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
29	Maximum temperature rise over 40 ^{o}C ambient when transformer is working at full load and tap changer is at normal position			
	a) Winding by resistance	^{o}C	65	
	b) Oil by temperature	^{o}C	60	
30	Type of base		Ground mounted	
31	Dimension of transformer			
	a) Width,	mm	To be mentioned	
	b) Length,	mm	To be mentioned	
	c) Height,	mm	To be mentioned	
	d) Tank Sheet thickness of top, bottom & side, mm			
32	Total weight of complete Transformer including fittings & oil, Kg	kg	To be mentioned	
33	Routine Test Report			
	a) Measurement of Voltage ratio test.		To be mentioned	
	b) Vector group test.		To be mentioned	
	c) Measurement of winding resistance.		To be mentioned	
	d) Measurement of insulation resistance.		To be mentioned	
	e) Measurement of no load loss & no-load current.		To be mentioned	
	f) Measurement of impedance voltage & load loss.		To be mentioned	
	g) Power frequency (Separate source voltage) withstands test.		To be mentioned	
	h) Transformer oil test.		To be mentioned	
34	Type Test Report			
	a) Impulse Voltage Withstand Test.		To be mentioned	
	b) Temperature Rise Test		To be mentioned	
	c) Short Circuit Test or details calculations on the basis of the design data		To be mentioned	

7. 33KV BUSBARS AND CONNECTIONS

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
A.	**CONDUCTORS AND CONNECTIONS**			
1.	Manufacturer		To be mentioned	
2.	Material of conductor		To be mentioned	
	a) Bus-bar		ACSR/2xMartin	
	b) Jumper/connections		To be mentioned	
3.	Overall diameter	mm	To be mentioned	
4.	Nominal cross section	mm^2	To be mentioned	
5.	Maximum rated current	A	2500	
6.	Maximum working tension of main connections	kg/m^2	To be mentioned	
7.	DC resistance of conductors per 1000 meters at 20ºC	Ohms	To be mentioned	
8.	Tensile breaking stress of material	N/mm^2	To be mentioned	
9.	Maximum permissible span length	m	To be mentioned	
10.	Maximum sag under own weight of maximum span	mm	To be mentioned	
11.	Temperature rise at rated current	ºC	35	

8. 33KV BUSBAR INSULATOR STRINGS

B.	**INSULATORS**			
1	Manufacturer	-	To be mentioned	
2	Model no.	-	To be mentioned	
3	Insulator material	-	Porcelain	
4	Number of units per string	Nos.	4	
5	Insulator Voltage Class	KV		
6.	Weight of insulator complete	kg		
7	Type of Insulator	-	Ball and socket type disc, security clip made of rod brass alloy.	
8	Creepage/ leakage distance (min.)	mm	To be mentioned	
9	Total creepage distance of string	mm	900	
10	Unit Spacing	mm	To be mentioned	
11	Dry Arcing distance (minimum)	mm	To be mentioned	
12	Diameter of Insulator	mm	To be mentioned	
13	Withstand Voltage, Minimum : a) Power Frequency, dry (one min.) b) Power Frequency, wet (one min.) c) Impulse 1.2/50 μ sec	 KV KV KV	 70 40 110	
14	Flashover Voltage, Minimum : a) Power Frequency, dry b) Power Frequency, wet c) 50% Impulse 1.2/50 μ sec wave, positive or impulse 1.2/50 μ sec wave positive. d) 50% Impulse 1.2/50 μ sec wave Negative	 KV KV KV KV	 80 50 125 130	
15	Power Frequency Puncture Voltage, minimum	KV	110	
16	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	
17	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	
18	Insulator Hardware		Insulator hardware for insulator strings or bus-support such shall have UTS-120 KN and galvanized as per BS-729.	
19	Standard		AS per latest editions of IEC-383.	

9. SHIELD WIRES, EARTHING GRID AND EARTHING ELECTRODE

A	SHIELD WIRES			
Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer		To be mentioned	
2	Conductor material		High strength steel	
3	Grade of steel	PSI	60000	
4	Nos. of strand	Nos	7	
5	Diameter of each strand	mm	3.25	
6	Overall diameter	mm	9.80	
7	Nominal cross section	mm^2	35	
8	Weight per 1000 meter length	kg	460	
9	Maximum rated current (3 sec)	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 20ºC	Ohms	To be mentioned	
12	Rated ultimate tensile strength	kg/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 linear expansion	cm/ºC	To be mentioned	
16	Class of zinc coating		class – A	
17	Galvanization		As per BS-729	
B	**EARTHING GRID**			
1	Manufacturer		To be mentioned	
2	Material		Copper	
3	Overall diameter	mm	To be mentioned	
4	Nominal cross section			
	A) interconnecting the earth electrodes	mm^2	To be mentioned	
	B) Connecting equipment to mesh	mm^2	To be mentioned	
5	Area of each earthing grid	mxm	To be mentioned	
6	Depth of bedding of conductor	mm	To be mentioned	
7	Maximum earth fault current for 3 sec	kA	31.5	
8	Resistance of conductors per 1000 meters at 20ºC	Ohms	To be mentioned	
C.	**EARTHING ELECTRODES**			
1	Manufacturer		To be mentioned	
2	Material		Copper	
3	Dimentions			
	a) Diameter		To be mentioned	
	b) Length		To be mentioned	
4	Number of electrodes per group		To be mentioned	
5	Number of earthing points		To be mentioned	
6	Caculated resistance of combined earth grid and points	Ohm	Less than 0.5	

10. BATTERIY AND CHARGER CUBICLE

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
A.	**BATTERY**			
1	Manufacturer		To be mentioned	
2	Model no		To be mentioned	
3	Electrolyte		Nickel Cadmium Alkaline	
4	Installation		Indoor	
5	Operating voltage	V DC	110	
6	Continuous Discharge Current at rate of 10 hour & Final Cell Voltage 1.1 Volt.	Amp	10	
7	Short Time Discharge Current at rate of 2 hour & Final Cell Voltage 1.1 Volt.	Amp	50	
8	Charging Voltage (Maximum)	Volt	1.54-1.69 Per Cell	
9	Normal float charge rate	A	To be mentioned	
10	Maximum boost charge rate	A	To be mentioned	
11	Voltage per cell	V/per cell	1.2	
12	Capacity at 5 hour rate	Ah	250	
13	Number of cells	Nos	92	
14	Float voltage per cell	V per cell	1.4-1.42	
	Discharge voltage	v per cell	1.3-1.5	
15	Battery voltage at end of the duty cycle	V	1.1V per cell	
16	Nominal charging rate	A	40	
17	Maximum charging rate	A	40	
18	Ampere-hour efficiency at ten hour rate	%	To be mentioned	
19	Ampere-hour efficiency at one hour rate	%	To be mentioned	
20	Dimensions of cells	mm	To be mentioned	
22	Weight of cell complete with electrolyte	kg	To be mentioned	
23	Internal resistance per cell when fully charged	ohms	To be mentioned	
24	Material of battery case		To be mentioned	
25	Standard		IEC 623	
B.	**CHARGER**			
1	Manufacturer		To be mentioned	
2	Model no		To be mentioned	
3	Rectifier Type		Thyristor	
4	AC input voltage	V	415V±15%	
5	Input a.c frequency	HZ	50±5%	
6	DC output voltage			
	a) Normal Charge	V DC	110±10%	
	b) Float Charge	V DC	1.42 for110±15%	
	c) Boost Charge	V DC	1.53 volt per cell	
7	Output current (continuous)	A	50	
8	Rated Battery Current	A	To be mentioned	
9	Efficiency	%	To be mentioned	
10	Ripple Voltage	%	To be mentioned	
11	Type of AVR		Static	
12	Standard	%	IEC-146	
C	**CHARGER CUBCLE COMPLETE**			
1	Manufacturer		To be mentioned	
2	Overall dimensions		To be mentioned	
3	Total weight		To be mentioned	

11. LV AC / DC DISTRIBUTION PANEL

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
A.	**AC DISTRIBUTION PANEL**			
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Bus bar rating	Amps	400	
4	Fault Rating for 1 sec.	KA	15	
5	Voltage	Volts	400	
6	Incoming breaker rating	A	400	
7	Thickness of sheet steel (encloser)	mm	To be mentioned	
8	Number and rating of circuits	Nos./A	To be mentioned	
9	Overall dimensions	mmxmmxmm	To be mentioned	
10	Total weight	Kg	To be mentioned	
11	MCCB			
	a) Manufacturr		To be mentioned	
	b) Model number		To be mentioned	
	c) Rated voltage	V	To be mentioned	
	d) Rated current	A	To be mentioned	
B.	**DC DISTRIBUTION PANEL**			
1	Manufacturer		To be mentioned	
2	Model number			
3	Bus bar rating	Amps	40	
4	Fault Rating for 1 sec	KA	6	
5	Voltage	Volts	400	
6	Incoming breaker rating	A	400	
7	Thickness of sheet steel (encloser)	mm	To be mentioned	
8	Number and rating of circuits	Nos./A	To be mentioned	
9	Overall dimensions	mmxmmxmm	To be mentioned	
10	Total weight	Kg	To be mentioned	
11	MCCB			
	a) Manufacturr		To be mentioned	
	b) Model number		To be mentioned	
	c) Rated voltage	V	To be mentioned	
	d) Rated current	A	To be mentioned	

12. 33KV CONTROL AND ENERGY METERING PANEL

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
A.	**33KV CONTROL PANEL**			
1	Manufacturer		To be mentioned	
2	Model number		To be mentioned	
3	Overall dimensions	mm	To be mentioned	
4	Weight of panel	Kg	To be mentioned	
A1.	**PROTECTION**			
A.1.1	**IDMT OVER CURRENT & EARTH FAULT RELAY**			
1	Manufacturer		Siemens (Germany)/ Alstom (UK/France)/ ABB (Switzerland/ Sweden	
2	Model number		To be mentioned	
3	Type of relay		Numerical Programmable	
4	Range of current setting			
	a) Phase element	% of CT rating	To be mentioned	
	b) Earth fault element	% of CT rating	To be mentioned	
5	Range of timing settings at 10 time CT rating	Sec	To be mentioned	
6	Burden of relay at 10 time CT rating	VA	To be mentioned	
7	Percentage of current setting at which relay will reset	%	To be mentioned	
8	Reset time after removal of 10 times CT rated current for:			
	a) Phase element (100%)	Sec	To be mentioned	
	b) E/F element (40%)	Sec	To be mentioned	
A2.	**METERING AND INDICATION**			
A.2.1	**KWH METER**		Separate Panel for Energy Metering	
1	Manufacturer		Siemens(Germany/ Switzerland)/Alstom,(UK)/ABB(Switzerland)/AEG(Germany)/Schlumberger (USA)	
2	Model number		To be mentioned	
3	Type of Meter		Numerical Programmable multifunction	
4	Number of KWH Meters		2 with provision of 4 meters in a separate metering panel	
5	Class of accuracy		0.2	

A2.2	**INDICATION METERS (VOLT, AMPERE, KW, KVAR & POWER FACTOR)**			
1	Manufacturer		Siemens(Germany/ Switzerland)/Alstom,(UK)/ABB(Switzerland)/AEG(Germany)/Schlumberger(USA)	
2	Model number		To be mentioned	
3	Type of Meter		Digital/Analog	
4	Class of accuracy		To be mentioned	

13. STEEL STRUCTURE

Sl. No.	Description	Unit	Requirement	Manufacturer's Guaranteed Data
1	Manufacturer	-	To be mentione	
2	Maximum ratio of unsupported length of steel compressi their least redius of gyration:			
	a) Main members	mm	120	
	b) Bracing's	mm	200	
	c) Redundant	mm	250	
3	Steel Grade Mild Steel			
	a) Elastic limit stress in tension members	Kg/ mm	To be mentione	
	b) Ultimate stress in compression members (expressed as function L/R)	Kg/ mm	To be mentione	
4	Steel Grade HTGH Tension Steel			
	a) Elastic limit stress in tension members	Kg/ mm	To be mentione	
	b) Ultimate stress in compression members (expressed function L/R)	Kg/ mm	To be mentione	
5	Minimum size of member	mm	45 x 45 x 6	
6	Weight of each Column	Kg	To be mentione	
7	Weight of each Girder	Kg	To be mentione	
8	Total weight	Kg	To be mentione	
9	Minimum member thickness	mm	6	
	Main member	mm	5	
	Other breching member	mm	5	
	Bolt diameter	mm	16	
10	Galvanizing thickness	mm	85	

14. Control cable

PVC insulated multi core control cable Laid up beded with PVC or tap. Flat / round wire armoring with helical steel taping and PVC sheathed, rated voltage 600/1000, continuous permissible voltage 720/1200 volts (VDE 0271/3.69 BDS 901: 85) (NYRGby) suitable for use in indoors, outdoors, underground and in water for continuous permissible service voltage of 720/1200 volts. Maximum resistance 4.73 ohm/km at 35°C.

a) Guaranteed Technical Particulars for 4C×4 mm2 XLPE Insulated and PE Sheathed Copper Cable

(To be filled u 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		4c×4 mm2×LPE Insulated and PE Sheathed Copper Cable with Armouring	
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	mm2	4C×4 rm	
6	Material		XLPE Insulated and PE Sheathed Copper Cable with Armouring	
7	Numbers & Diameter of Copper Wires	mm	7/0.85	
8	Numbers & Diameter of Steel Wires	mm	24/1.4	
9	Nominal size of Steel Tape	mm	8×0.3	
10	Maximum resistance at 30 deg.c	Ω/Km	4.56	
11	Nominal thickness of insulation	mm	0.8 (min)	
12	Nominal thickness of sheath	mm	1.8 (min)	
13	Colour of sheath		Black	
14	Colour of Core		Red, Yellow, Blue, Black	
15	Approximate outer diameter	mm	19	
16	Approximate weight	Kg/Km	760	
17	Drum wound length	m	1000	
18	Net Weight	Kg	Shall be mentioned	
19	Gross weight	Kg	Shall be mentioned	
20	Treated Wooden Drum Standard		AWPA C1-82, C2-83, c16-82, P5-83.	

b) Guaranteed Technical Particulars for 4C×6 mm^2 XLPE Insulated and PE Sheathed Copper Cable

(To be filled u 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		To be mentioned	
2	Name of the Manufacturer		To be mentioned	
3	Address of the Manufacturer		To be mentioned	
4	Standard		To be mentioned	
5	Cable Size	mm2	**4C×6 rm**	
6	Material		To be mentioned	
7	Numbers & Diameter of Copper Wires	mm	To be mentioned	
8	Numbers & Diameter of Steel Wires	mm	To be mentioned	
9	Nominal size of Steel Tape	mm	To be mentioned	
10	Maximum resistance at 30 deg.c	Ω/Km	To be mentioned	
11	Nominal thickness of insulation	mm	To be mentioned	
12	Nominal thickness of sheath	mm	To be mentioned	
13	Colour of sheath		To be mentioned	
14	Colour of Core		To be mentioned	
15	Approximate outer diameter	mm	To be mentioned	
16	Approximate weight	Kg/Km	To be mentioned	
17	Drum wound length	m	To be mentioned	
18	Net Weight	Kg	To be mentioned	
19	Gross weight	Kg	To be mentioned	
20	Treated Wooden Drum Standard		To be mentioned	

c) Guaranteed Technical Particulars for 2C×4 mm2 XLPE Insulated and PE Sheathed Copper Cable

(To be filled u 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		To be mentioned	
2	Name of the Manufacturer		To be mentioned	
3	Address of the Manufacturer		To be mentioned	
4	Standard		To be mentioned	
5	Cable Size	mm2	**2C×4 rm**	
6	Material		To be mentioned	
7	Numbers & Diameter of Copper Wires	mm	To be mentioned	
8	Numbers & Diameter of Steel Wires	mm	To be mentioned	
9	Nominal size of Steel Tape	mm	To be mentioned	
10	Maximum resistance at 30 deg.c	Ω/Km	To be mentioned	
11	Nominal thickness of insulation	mm	To be mentioned	
12	Nominal thickness of sheath	mm	To be mentioned	
13	Colour of sheath		To be mentioned	
14	Colour of Core		To be mentioned	
15	Approximate outer diameter	mm	To be mentioned	
16	Approximate weight	Kg/Km	To be mentioned	
17	Drum wound length	m	To be mentioned	
18	Net Weight	Kg	To be mentioned	
19	Gross weight	Kg	To be mentioned	
20	Treated Wooden Drum Standard		To be mentioned	

d) Guaranteed Technical Particulars for 2C×6 mm2 XLPE Insulated and PE Sheathed Copper Cable

(To be filled u 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		To be mentioned	
2	Name of the Manufacturer		To be mentioned	
3	Address of the Manufacturer		To be mentioned	
4	Standard		To be mentioned	
5	Cable Size	mm2	2C×6 rm	
6	Material		To be mentioned	
7	Numbers & Diameter of Copper Wires	mm	To be mentioned	
8	Numbers & Diameter of Steel Wires	mm	To be mentioned	
9	Nominal size of Steel Tape	mm	To be mentioned	
10	Maximum resistance at 30 deg.c	Ω/Km	To be mentioned	
11	Nominal thickness of insulation	mm	To be mentioned	
12	Nominal thickness of sheath	mm	To be mentioned	
13	Colour of sheath		To be mentioned	
14	Colour of Core		To be mentioned	
15	Approximate outer diameter	mm	To be mentioned	
16	Approximate weight	Kg/Km	To be mentioned	
17	Drum wound length	m	To be mentioned	
18	Net Weight	Kg	To be mentioned	
19	Gross weight	Kg	To be mentioned	
20	Treated Wooden Drum Standard		To be mentioned	

e) Guaranteed Technical Particulars for 19C×4 mm2 XLPE Insulated and PE Sheathed Copper Cable

(To be filled u 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		To be mentioned	
2	Name of the Manufacturer		To be mentioned	
3	Address of the Manufacturer		To be mentioned	
4	Standard		To be mentioned	
5	Cable Size	mm^2	**19C×4 rm**	
6	Material		To be mentioned	
7	Numbers & Diameter of Copper Wires	mm	To be mentioned	
8	Numbers & Diameter of Steel Wires	mm	To be mentioned	
9	Nominal size of Steel Tape	mm	To be mentioned	
10	Maximum resistance at 30 deg.c	Ω/Km	To be mentioned	
11	Nominal thickness of insulation	mm	To be mentioned	
12	Nominal thickness of sheath	mm	To be mentioned	
13	Colour of sheath		To be mentioned	
14	Colour of Core		To be mentioned	
15	Approximate outer diameter	mm	To be mentioned	
16	Approximate weight	Kg/Km	To be mentioned	
17	Drum wound length	m	To be mentioned	
18	Net Weight	Kg	To be mentioned	
19	Gross weight	Kg	To be mentioned	
20	Treated Wooden Drum Standard		To be mentioned	

15. POWER CABLES

15.1. 33 KV POWER CABLES (U/G)

Guaranteed Technical Data Schedule of 33KV, 1-Core × 500 Sq.mm U/G XLPE Copper Cable

SL No.	Description	Unit	Required Specification	Manufacturer's Particulars
1	Name and address of the Manufacturer		To be mentioned	
2	Type/Model of the offered cable		To be mentioned	
3	Nominal system voltage	KV	33	
4	Rated voltage of cable	KV	18/30(36)	
5	Process of manufacturing		VCV/CCV	
6	Number of core and cross sectional area of conductor cores	Sq.mm	1×500	
7	Conductor material		Copper	
8	Minimum no of strand	No.	53	
9	Diameter of each strand	mm	To be mentioned	
10	Shape of conductor		Compacted Circular	
11	Type of conductor screen		Semi-conducting	
12	Thickness of semi conducting screen	mm	0.6	
13	Avg. thickness of insulation	mm	8.0	
14	Process of curing		Dry process	
15	Material of insulation		Cross Linked Polyethylene (XLPE)	
16	Type of non metallic insulating screen		Semi-conducting	
17	Thickness of semi conducting insulation screen	mm	1.0	
18	Number and diameter of copper screen strands	No./mm	Based on design calculation	
19	Composition of filler		PVC	
20	Composition of bedding		Extruded PVC	
21	Thickness of bedding	mm	Based on design calculation	
22	Number and diameter of armour wire	No./mm	As per IEC 60502	
23	Avg. thickness of MDPE over sheath	mm	Based on design calculation	
24	Nominal diameter of complete cable	mm	Based on design calculation	
25	Nominal weight per meter of complete cable	Kg/m	Based on design calculation	
26	Minimum radius of bend round which cable can be laid	mm	Based on design calculation	
27	Max. D.C resistance of conductor per meter at 20̊ C	Ohm/m	Based on design calculation	
28	Max. A.C resistance of conductor per meter at MAXIMUM CONDUCTOR TEMPARATURE	Ohm/m	Based on design calculation	

29	Star resistance per meter of cable at 50Hz	Ohm/m	Based on design calculation	
30	Star capacitance per per meter of cable at 50Hz	pF/m	Based on design calculation	
31	Charging current per conductor per meter at 18000/30000 Volts , 50Hz	mA	Based on design calculation	
32	Maximum current carrying capacity of conductor in ground	A	Based on design calculation	
33	Maximum conductor temperature under continuous loading	℃	Based on design calculation	
34	Short circuit withstand capacity nof the cable for 1 sec. duration	KA	Min. 25	
35	conductor temperature at the end of short circuit	℃	≤250	
36	Earth fault withstand capacity for 1 sec.	KA	Min. 25	
37	Screen short circuit withstand capacity	KA	Min. 25	
38	Armour short circuit capacity	KA	Based on design calculation	
39	Cable resistance, reactance			
	a) for positive sequence	Ohm/m	Based on design calculation	
	b) negative sequence	Ohm/m	Based on design calculation	
	c) Zero sequence	Ohm/m	Based on design calculation	

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE F

DEPARTURES FROM SPECIFICATIONS

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE F

DEPARTURES FROM SPECIFICATIONS

Tenderers are to list all departures from the requirements of the specification in this schedule. All departures whether they be commercial, financial, technical or of a contractual nature are to be included and submitted with the Technical Proposal.

Any item that does not have a departure listed in this schedule will be deemed to be in full accordance with the requirements of the specification.

No other document or detail accompanying the tender will be considered in evaluating departures. Tenderers are not permitted to offer any alternative to this schedule.

Item	Volume	Clause	Detail of Departure from Specification

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE G

PROPOSED ALTERNATIVE STANDARDS TO WHICH EQUIPMENT SHALL BE PROVIDED

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE G

PROPOSED ALTERNATIVE STANDARDS TO WHICH EQUIPMENT SHALL BE PROVIDED

The Tenderer shall list below all the alternative engineering and design Standards, which he proposes to use in his design, manufacture and testing of equipment to be supplied. Should these standards differ from the specified standard in any respect, the Tenderer shall detail the differences between the proposed and specified standard.

Compliance with any standard equal or superior to those specified will be considered acceptable.

In the absence of any listed alternative standard, it is deemed that the standards specified in the Tender Documents are fully complied with.

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE H

PROPOSED CONTRACT AND SITE ORGANISATION AND SITE RESOURCES

BANGLADESH RURAL ELECTRIFICATION BOARD

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE H

PROPOSED CONTRACT AND SITE ORGANISATION AND SITE RESOURCES

The Tenderer is required to provide full organization charts of his proposed head office and site office arrangements. This should include how site subcontractors are to interface with the contractor's organization.

The Tenderer shall list in the form of Schedule attached, the key personnel (including first nominee and the second choice alternate)he will employ at head office and site office to direct and execute and work for the execution of the Contract together with their qualifications, positions held and their nationalities. Should specialist sub-designers be proposed (e.g civil designers) details of these are also to be provided with how this interface with the contractor's organization.

Should the Tenderer be proposing to put any restriction on his site managers authority to carry out the instructions issued by the Employer Representative, full details of these, be they financial/contractual/technical are to be provided in the tender.

The information provided in the Tender in accordance with the above, will not represent any limitations on the staff required to perform the works in accordance with the conditions of Contract. Should the Contractor require utilizing additional staff to those proposed in order to meet his obligations these are to be provided at no additional cost. The Contractor shall however have to employ all the expatriate staffs proposed in the tender as to be employed at site. In case of failure to employ the expatriate staffs at site as per tender proposal, the Employer may go for termination of the Contract.

In addition the Tenderer is required to provide a schedule of the site resources he intends to provide, e.g. equipment for haulage, lifting, site power supplies, foundation, erection, stringing, testing and commissioning. Major items of equipment for construction purposes, which the Tenderer proposes to import, are to be submitted with the Tender. The Tenderer shall have to bring the above proposed equipment during construction otherwise they may be panelized, as per clause of the tender, for any delay due to non-availability of such equipment at site. The successful Tenderer will be required to submit detailed schedules of his proposed site testing and commissioning equipment and experience of his commissioning engineers.

The Tenderer is also required to provide details of his site organization concerning office locations, storage facilities proposed, both open and covered, site transportation, etc. The successful Tenderer will be required to provide details of his proposed organizational procedures for the receipt, inspection and transportation of plant, plus monthly progress monitoring, invoice submission etc.

The Contractor shall ensure that the cash flow is maintained as forecasted in their price proposal. In case there is any liquidity problem for which there is any delay in implementing the project, the Contractor may be panelized as per tender.

SCHEDULE H OF KEY PERSONNEL

Position	Name	Nationality	Summary of qualifications, experience and present occupation
Head Office Staff: Site Office Staff:			

Signature and Seal of the Tenderer

SCHEDULE H OF EQUIPMENT FOR CONSTRUCTION

Name of Equipment	Ownership	Present Location

Signature and Seal of the Tenderer

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE I

DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH TENDER

BANGLADESH RURAL ELECTRIFICATION BOARD

SCHEDULE I

DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH TENDER FOR 33 KV SWITCHING STATION WORK

The Tenderer shall submit the following drawings/documents with the tender:

1. Typical plan and section drawings of transformer incoming, bus coupler and outgoing feeders for 33 kV switchyard.
2. Block diagram showing overall dimensions of 33kV switchyard at site.
3. Drawings of circuit breakers, disconnecting switches, current transformers, voltage transformers, lightning arresters and disc Insulator units showing details of construction and dimensions.
4. Typical arrangement drawing of control panel cubicles, energy meter panel cubicle, battery charger cubicle, LVAC and DC distribution boards.
5. Typical block-schematic and logic diagrams of all protection and control schemes.
6. Lay-out Plan of control panel to be installed in substation control room building.
7. Cross Section Drawing of the head design of the insulator unit.
8. Type test certificate of the following shall be submitted as per relevant IEC/BS standards.

   i) Circuit Breaker (VCB)

      (a) Lightning impulse voltage withstand dry test
      (b) Temperature rise test
      (c) Power frequency withstand test
      (d) Short time withstand & Peak withstand current test
      (e) Mechanical operation tests
      (f) Short Circuit Current making & breaking test
      (g) Out of phase making & breaking test

   ii) Disconnecting Switch DS/ES)

      (a) Lightning Impulse voltage withstand dry test
      (b) Power frequency voltage withstand dry test
      (c) Short time withstand current test

   iii) Current Transformer (CT)

      (a) Short time current test
      (b) Impulse voltage withstands tests for current transformers for service in exposed installation.
      (c) Power frequency voltage withstand test
      (d) Temperature rise test

iv) Voltage Transformer (VT)

(a) Temperature rise test
(b) Impulse voltage withstand tests for voltage transformers for service in exposed installation.
(c) Short circuit test
(d) Short time over voltage test

v) Lightning Arrester (LA)

(a) Lightning impulse voltage withstand test on Arrester Housing
(b) Lightning impulse residual voltage test
(c) Step current impulse residual voltage test
(d) Long duration current impulse withstand test
(e) High Current Impulse withstand test
(f) Pressure relief test

vi) Disc Insulator units

(a) Mechanical failing load test
(b) Impulse voltage puncture test
(c) Power are test
(d) Residual strength test

9. Type test certificates of the above equipment shall be from independent testing laboratory.

10. Quality Assurance Certificate ISO9001/9002 Certification (or equivalent and Quality Assurance Program & Typical Quality Plan for the work from the manufacturers of the following equipment:

i) Circuit breaker
ii) Disconnecting switch
iii) Current transformer
iv) Voltage transformer
v) Lightning arrester
vi) Insulator
vii) Relays

DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH TENDER FOR 33 KV LINE AUGMENTATION WORK

1. According to design & drawing, Technical Specification and GTP of all materials to be used for augmentation of 33 kV existing line.

2. Relevant all Test Report of all materials to be used for augmentation of 33 kV existing line confirming the Technical Specification and GTP submitted by the Tenderer.

3. Manufacturer's Assurance Certificate for supplying line materials in favour of the Tender.

4. Quality Assurance Certificate ISO9001/9002 Certification (or equivalent and Quality Assurance Program & Typical Quality Plan for the work from the manufacturers of the required materials for 33 kV line augmentation work.
5. Brochure/Catalog of manufacturer indicating manufacturing facilities and available materials.

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE J

PROPOSED SUBCONTRACTORS

BANGLADESH RURAL ELECTRIFICATION BOARD

SCHEDULE J

PROPOSED SUBCONTRACTORS

The Tenderer shall propose a list of the subcontractors in the following table as per sub-clause 4.5 Subcontractors, Part – II, Conditions of Particular Application of Volume 1 of 3.

Sl. No.	Name and Address of the Subcontractors

Signature----------
Date----------

BANGLADESH RURAL ELECTRIFICATION BOARD

TENDER DOCUMENT

FOR

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

SCHEDULE K

MANUFACTURER'S AUTHORIZATION LETTER

BANGLADESH RURAL ELECTRIFICATION BOARD

SCHEDULE K

Manufacturer's Authorization Letter

[This letter of authorization should be on the letterhead of the manufacturer and should be signed by the person with the proper authority to sign documents that are binding on the manufacturer]

Invitation for Tender No: Date:

Tender Identification No:

To:

(Name and address of The Employer)

WHEREAS, we [name and address of manufacturer] are reputable manufacturers having factories at [list of places of factories].

Therefore, we do hereby:

1. Authorize [name of Tenderer] to submit a Tender in response to the invitation for Tenders indicated above, the purpose of which is to provide the [description of goods], manufactured by us, and to subsequently sign the Contract for the supply of such Goods; and,

2. Extend our full guarantee and warranty in accordance with GCC Clause 10 with respect to the Goods offered in the Tender.

Signed

In the capacity of:

Duly authorized to sign the authorization for and on behalf of

[name of manufacturer]

Date:

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

TENDER DOCUMENT
FOR THE

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING WORK FOR EXTENSION OF 33 KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION FOR BAGERHAT PBS UNDER BREB.

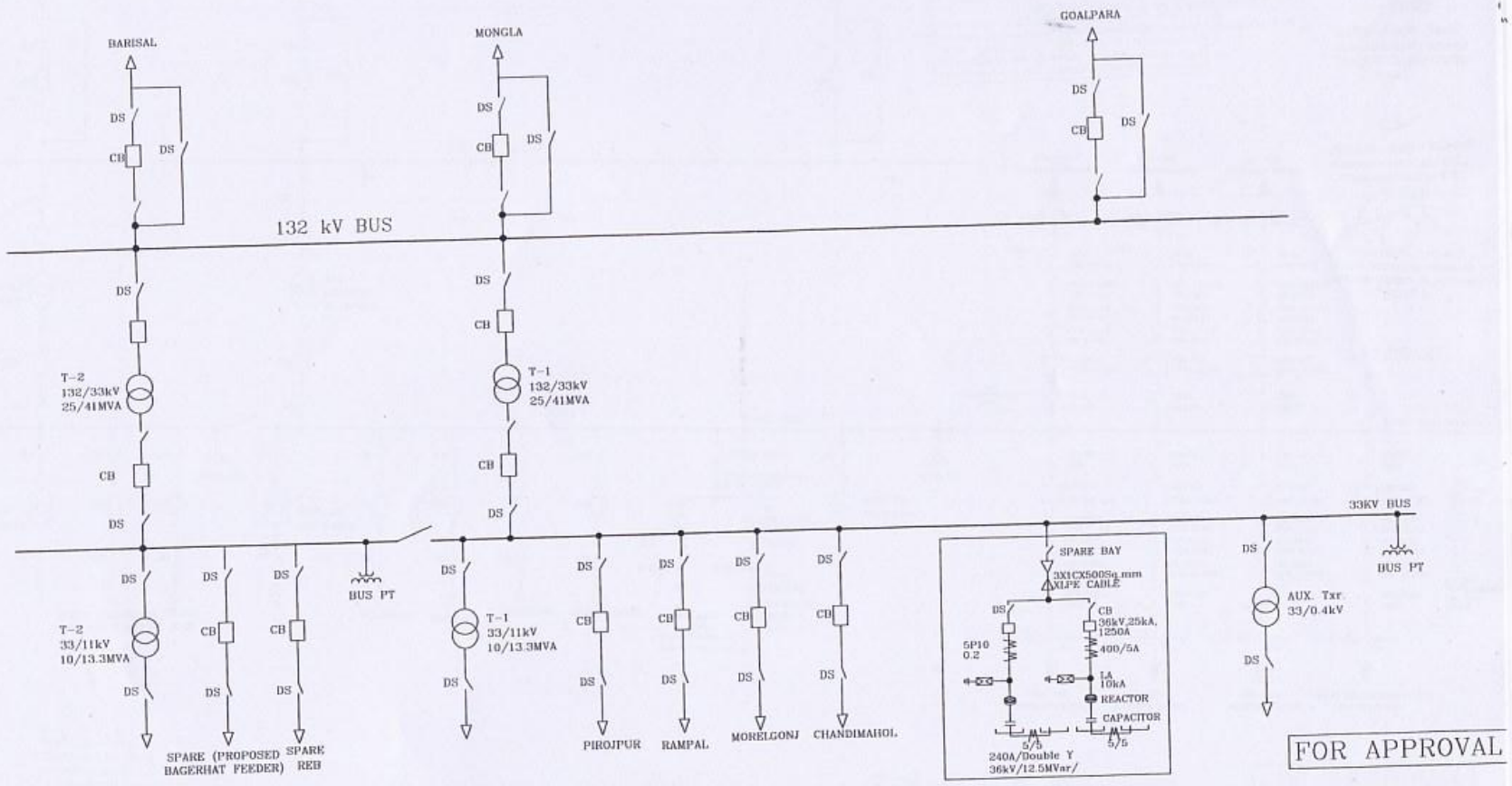
VOLUME 3 OF 3

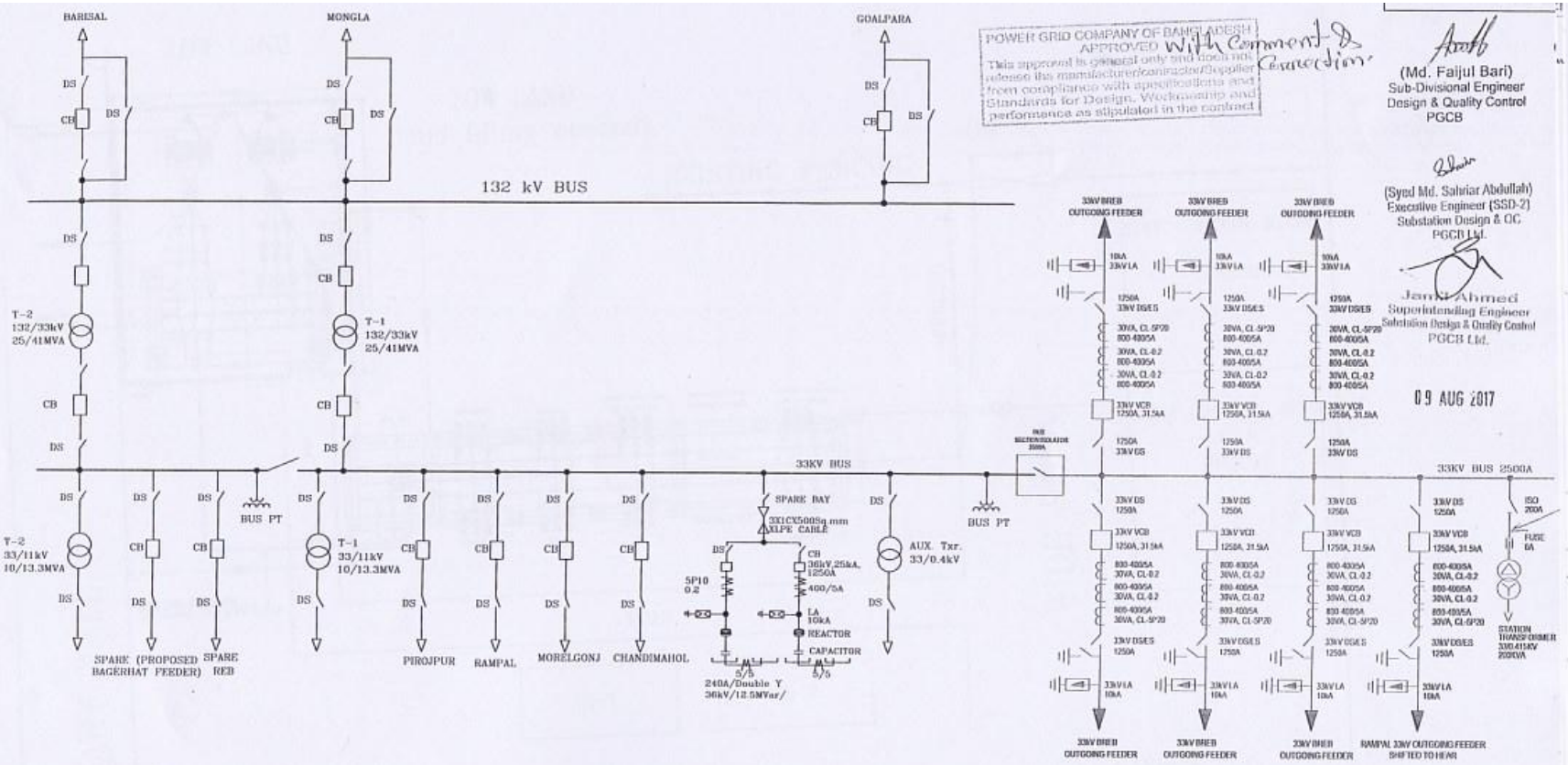
SECTION:9- DRAWINGS

বাংলাদেশ পল্লী বিদ্যুতায়ন বোর্ড

BANGLADESH RURAL ELECTRIFICATION BOARD (BREB).

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION AT BAGERHAT PBS UNDER BREB.


BARISAL
MONGLA
GOALPARA
132 kV BUS
DS
CB
T-2
132/33kV
25/41MVA
T-1
132/33kV
25/41MVA
T-2
33/11kV
10/13.3MVA
T-1
33/11kV
10/13.3MVA
BUS PT
SPARE (PROPOSED BAGERHAT FEEDER)
SPARE REB
PIROJPUR
RAMPAL
MORELGONJ
CHANDIMAHOL
SPARE BAY
3X1CX500Sq.mm XLPE CABLE
CB 36kV,25kA, 1250A
400/5A
5P10 0.2
1A 10kA
REACTOR
CAPACITOR
5/5
240A/Double Y 36kV/12.5MVar/
33KV BUS
AUX. Txr. 33/0.4kV
FOR APPROVAL
BANGLADESH RURAL ELECTRIFICATION BOARD
PROJECT : TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 2 NOS BAY BREAKER EXTENSION OF 132/33KV BAGERHAT GRID SUB-STATION AT BAGERHAT PBS UNDER BREB.
SCALE MTS
DRAWN S.I.
CHECKED T.I.
DESIGNED T.I.
DATE 26.05.2015
NAME OF SUBSTATION : BAGERHAT 132/33kV GRID S
TITLE : EXISTING SINGLE LINE DIAGRAM OF 132/33kV SUB-STATION.
DRAWING NO. : BREB/BAGERHAT/SLD/E1



POWER GRID COMPANY OF BANGLADESH
APPROVED With Comment & Correction
This approval is general only and does not release the manufacturer/contractor/Supplier from compliance with specifications and Standards for Design, Workmanship and performance as stipulated in the contract

(Md. Faijul Bari)
Sub-Divisional Engineer
Design & Quality Control
PGCB

(Syed Md. Sahriar Abdullah)
Executive Engineer (SSD-2)
Substation Design & QC
PGCB Ltd.

Janat Ahmed
Superintending Engineer
Substation Design & Quality Control
PGCB Ltd.

09 AUG 2017

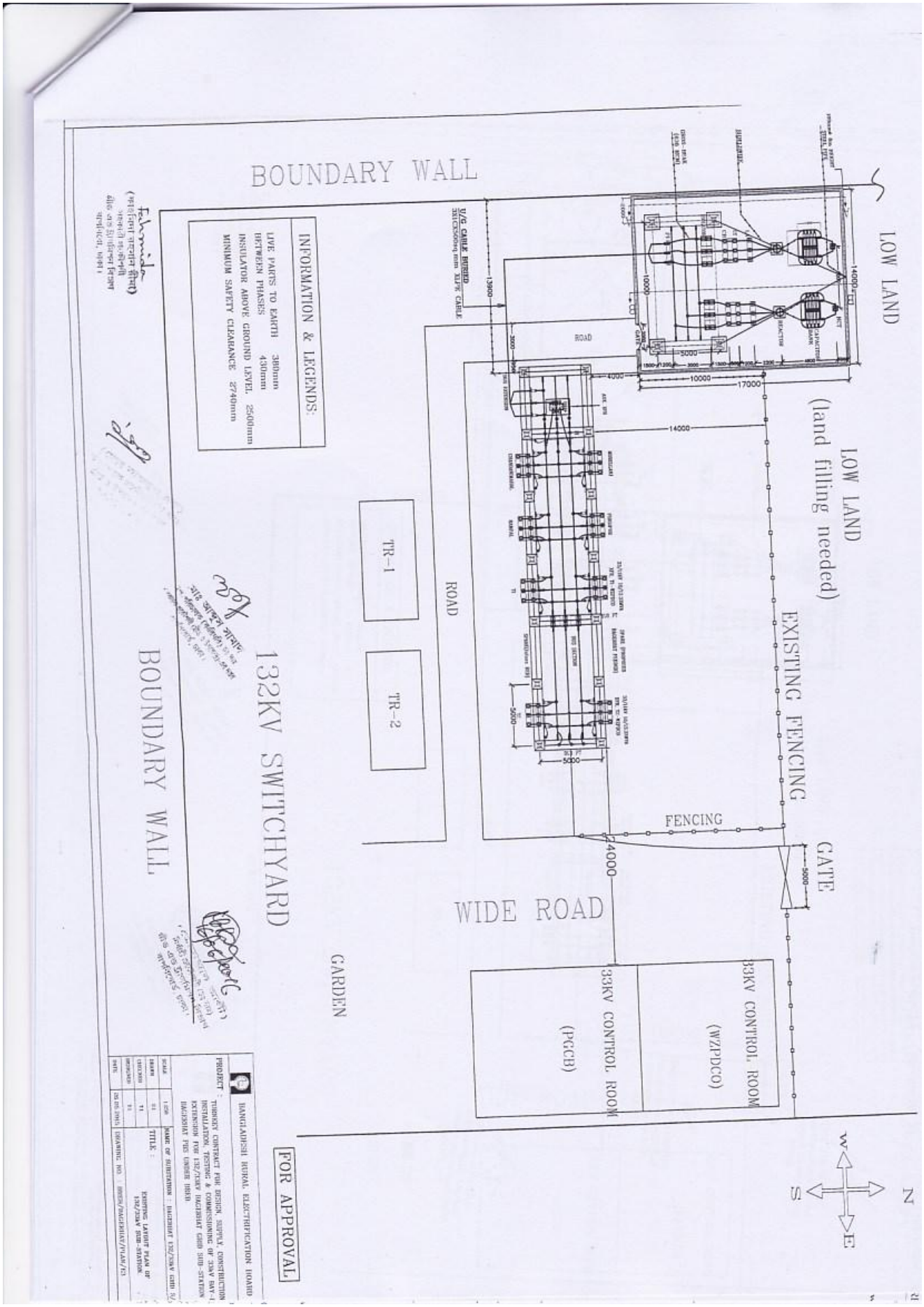
Fahmida

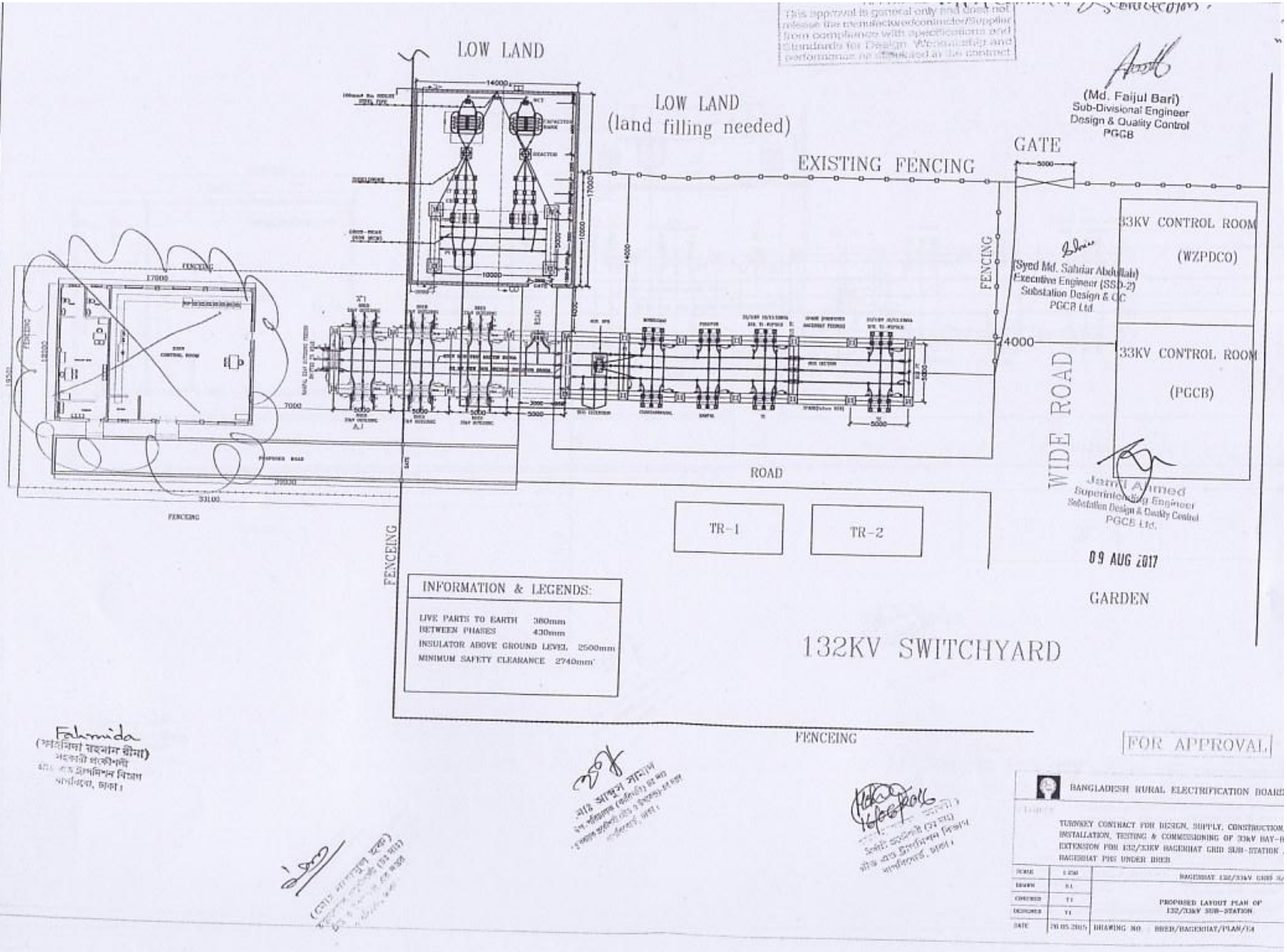
FOR APPROVAL

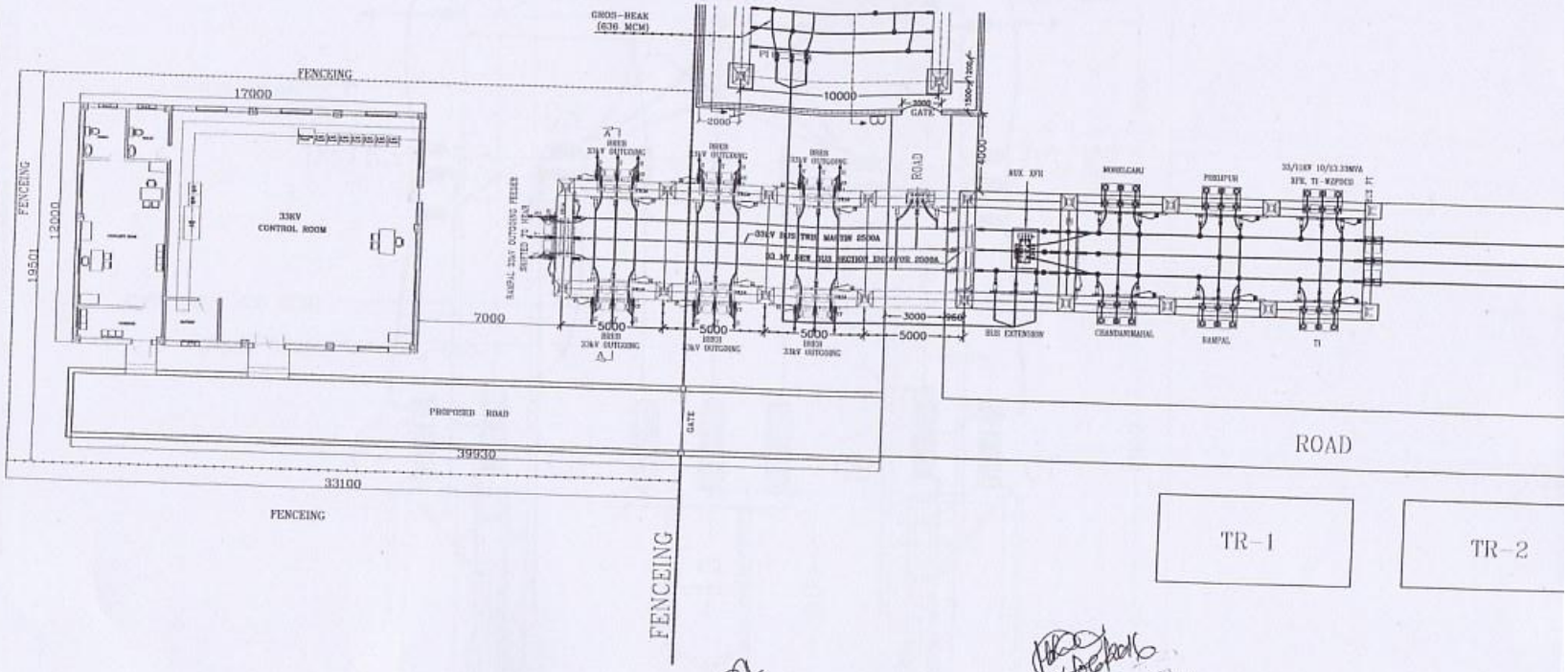
BANGLADESH RURAL ELECTRIFICATION BOARD (BRE

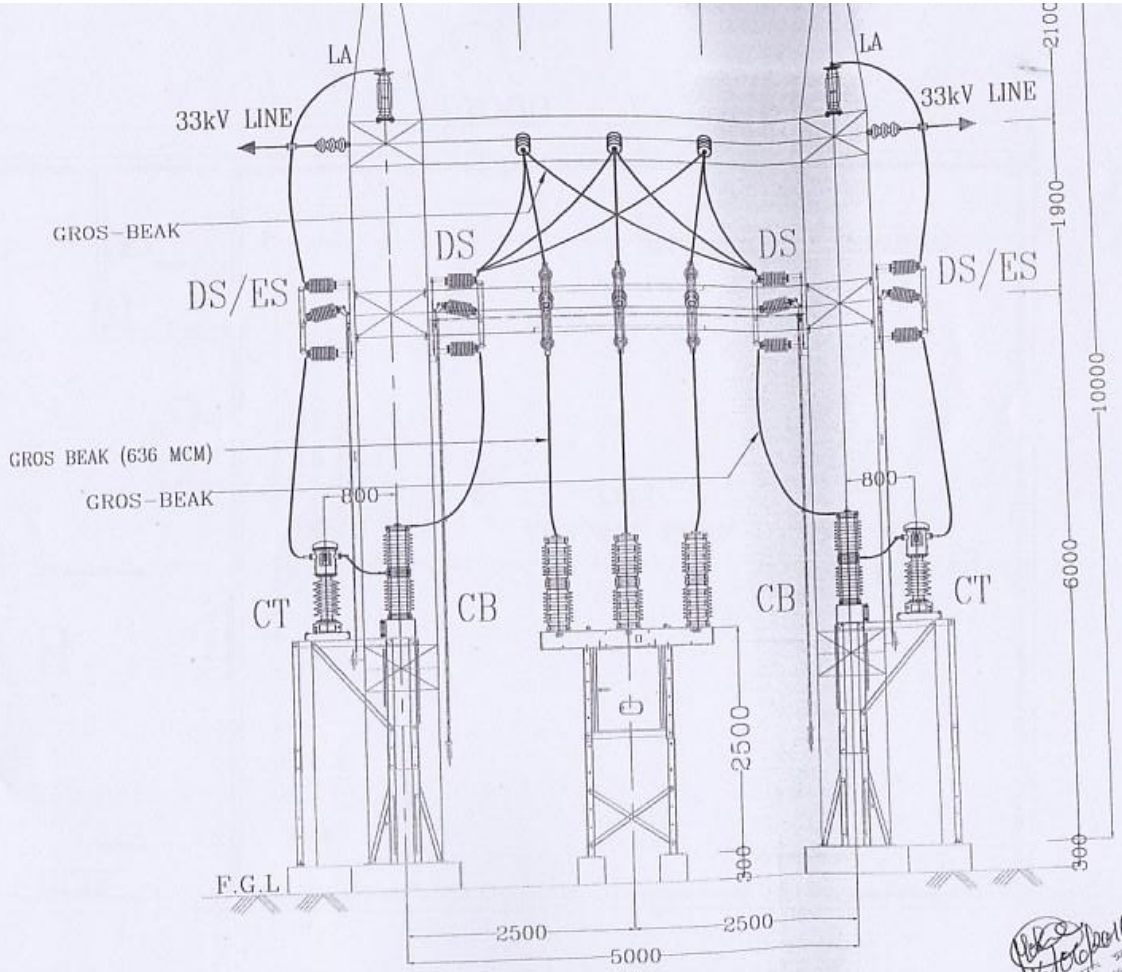
PROJECT: TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY-BREAK EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION AT BAGERHAT PBS UNDER BREB

SCALE	NTS	BAGERHAT 132/33kV GRID S/S.
DRAWN	S.I.	
CHECKED	T.I.	PROPOSED SINGLE LINE DIAGRAM OF 132/33kV SUB-STATION.
DESIGNED	T.I.	
DATE	26.05.2015	DRAWING NO. : BREB/BAGERHAT/SLD/E2 — REV


LOW LAND
BOUNDARY WALL
LOW LAND
(land filling needed)
EXISTING FENCING
GATE
FENCING
WIDE ROAD
GARDEN
ROAD
TR-1
TR-2
132KV SWITCHYARD
BOUNDARY WALL
33KV CONTROL ROOM
(WZPDCO)
33KV CONTROL ROOM
(PGCB)
INFORMATION & LEGENDS:
LIVE PARTS TO EARTH 380mm
BETWEEN PHASES 430mm
INSULATOR ABOVE GROUND LEVEL 2500mm
MINIMUM SAFETY CLEARANCE 2740mm
U/G CABLE BURIED
3X1C630mm2 XLPE CABLE
FOR APPROVAL
BANGLADESH RURAL ELECTRIFICATION BOARD
PROJECT : TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY-1 EXTENSION FOR 132/33kV BAGERHAT GRID SUB-STATION
NAME OF SUBSTATION : BAGERHAT 132/33kV GSS
TITLE : EXISTING LAYOUT PLAN OF 132/33kV SUB-STATION
DRAWING NO. BREB/BAGERHAT/132/01
DATE 05.05.2015
N
S
E
W


This approval is general only and does not release the manufacturer/contractor/Supplier from compliance with specifications and Standards for Design, Workmanship and performance as specified in the contract
LOW LAND
LOW LAND
(land filling needed)
EXISTING FENCING
GATE
(Md. Faijul Bari)
Sub-Divisional Engineer
Design & Quality Control
PGCB
33KV CONTROL ROOM
(WZPDCO)
(Syed Md. Sabiar Abdullah)
Executive Engineer (SSD-2)
Substation Design & QC
PGCB Ltd.
33KV CONTROL ROOM
(PGCB)
FENCING
WIDE ROAD
ROAD
TR-1
TR-2
Jamil Ahmed
Superintending Engineer
Substation Design & Quality Control
PGCB Ltd.
09 AUG 2017
GARDEN
INFORMATION & LEGENDS:
LIVE PARTS TO EARTH 380mm
BETWEEN PHASES 430mm
INSULATOR ABOVE GROUND LEVEL 2500mm
MINIMUM SAFETY CLEARANCE 2740mm
132KV SWITCHYARD
FENCEING
FOR APPROVAL
BANGLADESH RURAL ELECTRIFICATION BOARD
TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY-II EXTENSION FOR 132/33kV BAGERHAT GRID SUB-STATION BAGERHAT PBS UNDER BREB
PROPOSED LAYOUT PLAN OF 132/33kV SUB-STATION
DRAWING NO. BREB/BAGERHAT/PLAN/14


FENCEING
17000
12000
19501
33KV CONTROL ROOM
7000
GROS-HEAK (636 MCM)
10000
2000
GATE
4000
ROAD
AUX. XFR
MOHELCARI
PIRIRPUR
33/11KV 10/13.33MVA
BUS EXTENSION
CHANDANMAHAL
RAMPAL
TI
5000
3000
PROPOSED ROAD
39930
33100
FENCEING
TR-1
TR-2
FOR APPROVAL
BANGLADESH RURAL ELECTRIFICATION BOA
TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTI
INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY
EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATIO
BAGERHAT PBS UNDER BREB.
BAGERHAT 132/33kV GRID
SWITCHING LAYOUT PLAN OF
132/33kV SUB-STATION.
DRAWING NO : BREB/BAGERHAT/PLAN/25
Fahmida
(ফাহমিদা রহমান রীমা)
নির্বাহী প্রকৌশলী
বিতরণ প্রকৌশল বিভাগ
নথিবিধ, ঢাকা।



SECTION A—A

FOR APPROV

BANGLADESH RURAL ELECTRIFICATI

TURNKEY CONTRACT FOR DESIGN, SUPPLY, CO
INSTALLATION, TESTING & COMMISSIONING OF
EXTENSION FOR 132/33kV BAGERHAT GRID SU
BAGERHAT PBS UNDER BREB.

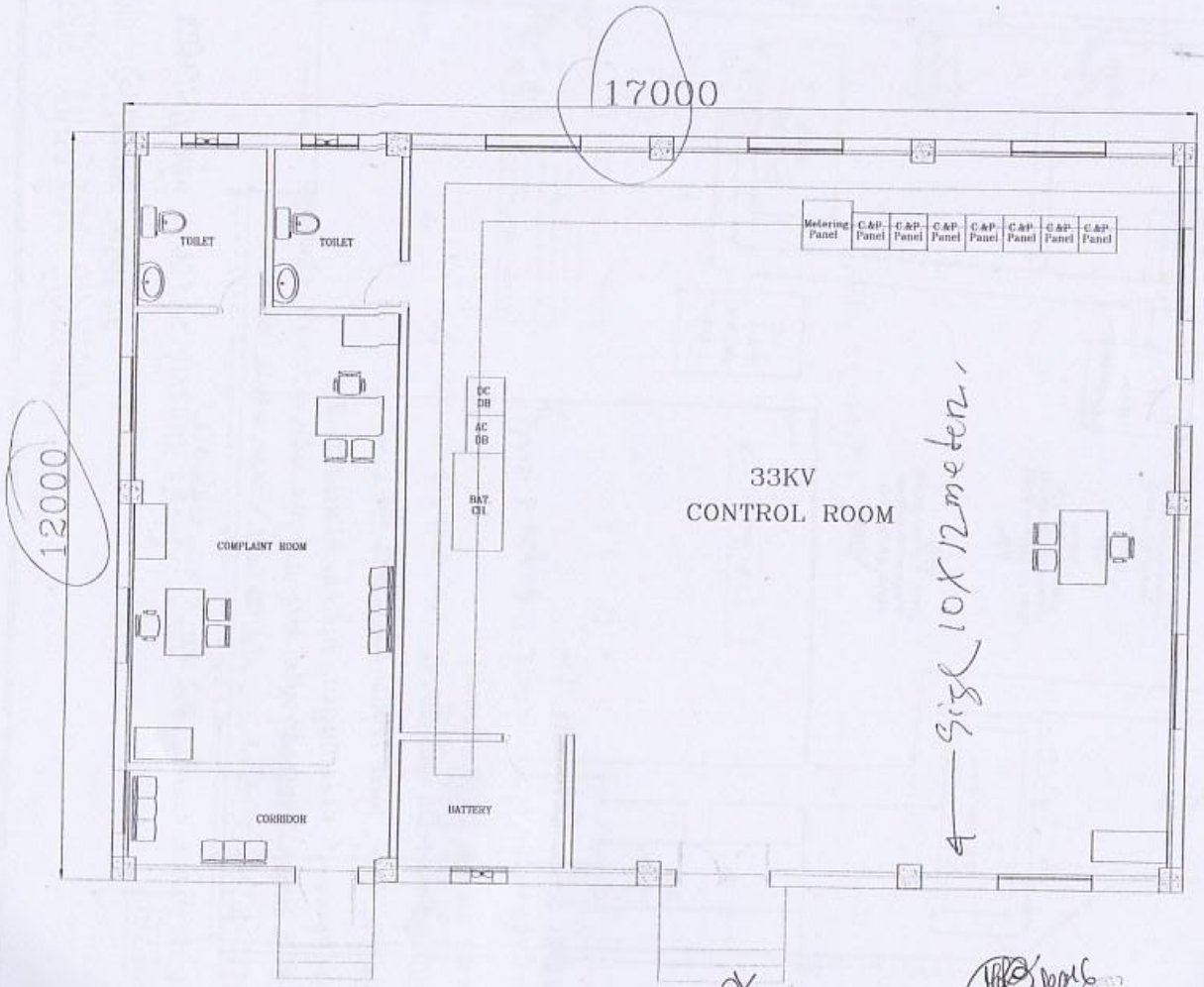
SCALE	1:50	BAGERHAT 132/
DRAWN	S.I.	SECTION (A-A) 132/33kV SUB-ST
CHECKED	T.I.	
DESIGNED	T.I.	
DATE	20.05.2015	DRAWING NO. BREB/BAGERHAT/SU

Fahmida
(ফাহমিদা রহমান রীমা)
সহকারী প্রকৌশলী
এবং এস ট্রান্সমিশন বিভাগ
বাপবিবোর্ড, ঢাকা।

(মোঃ সাজ্জাদুল হক)

মোঃ আব্দুল সামাদ

16/06/2016



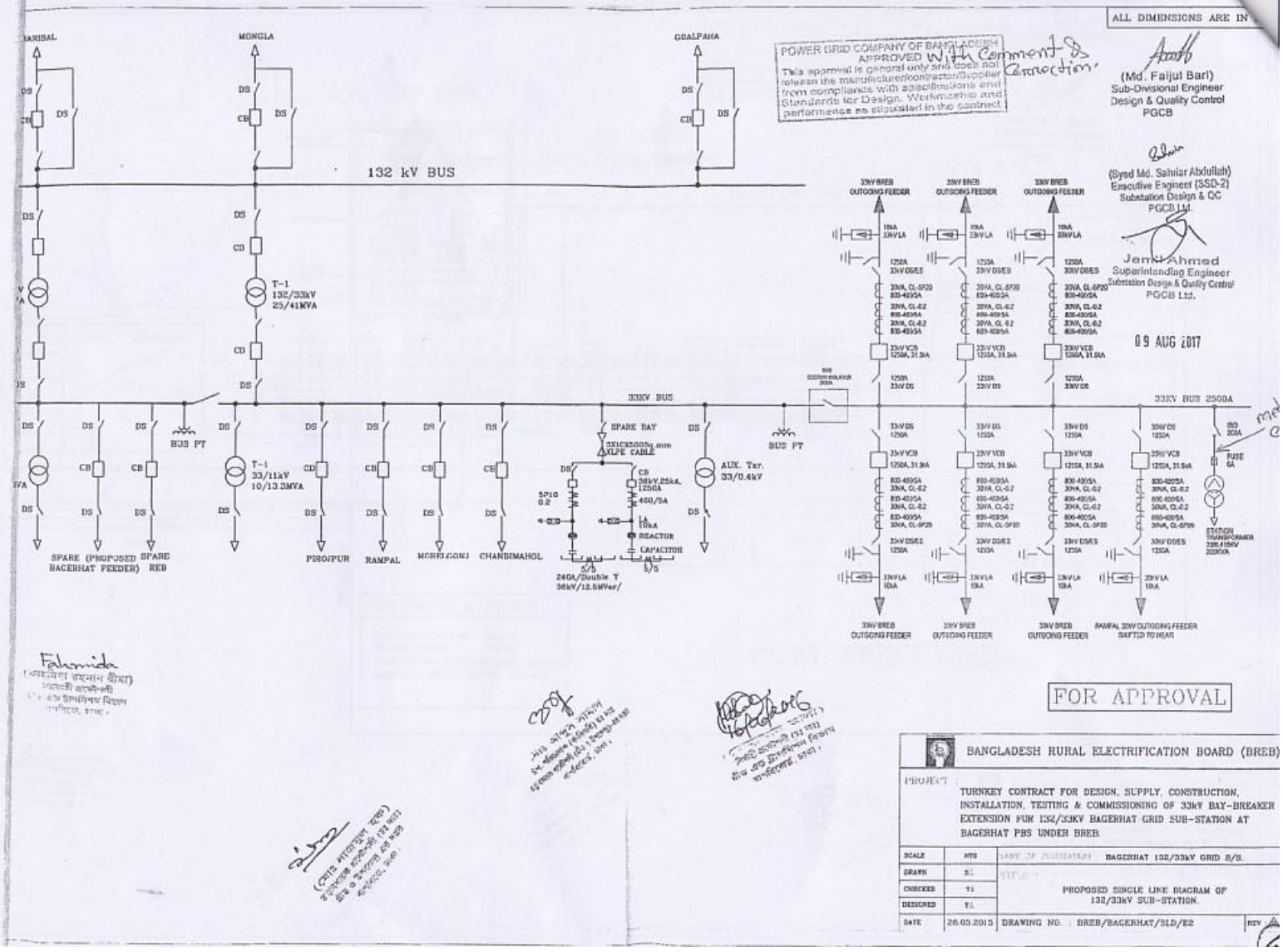
FOR APPROVAL

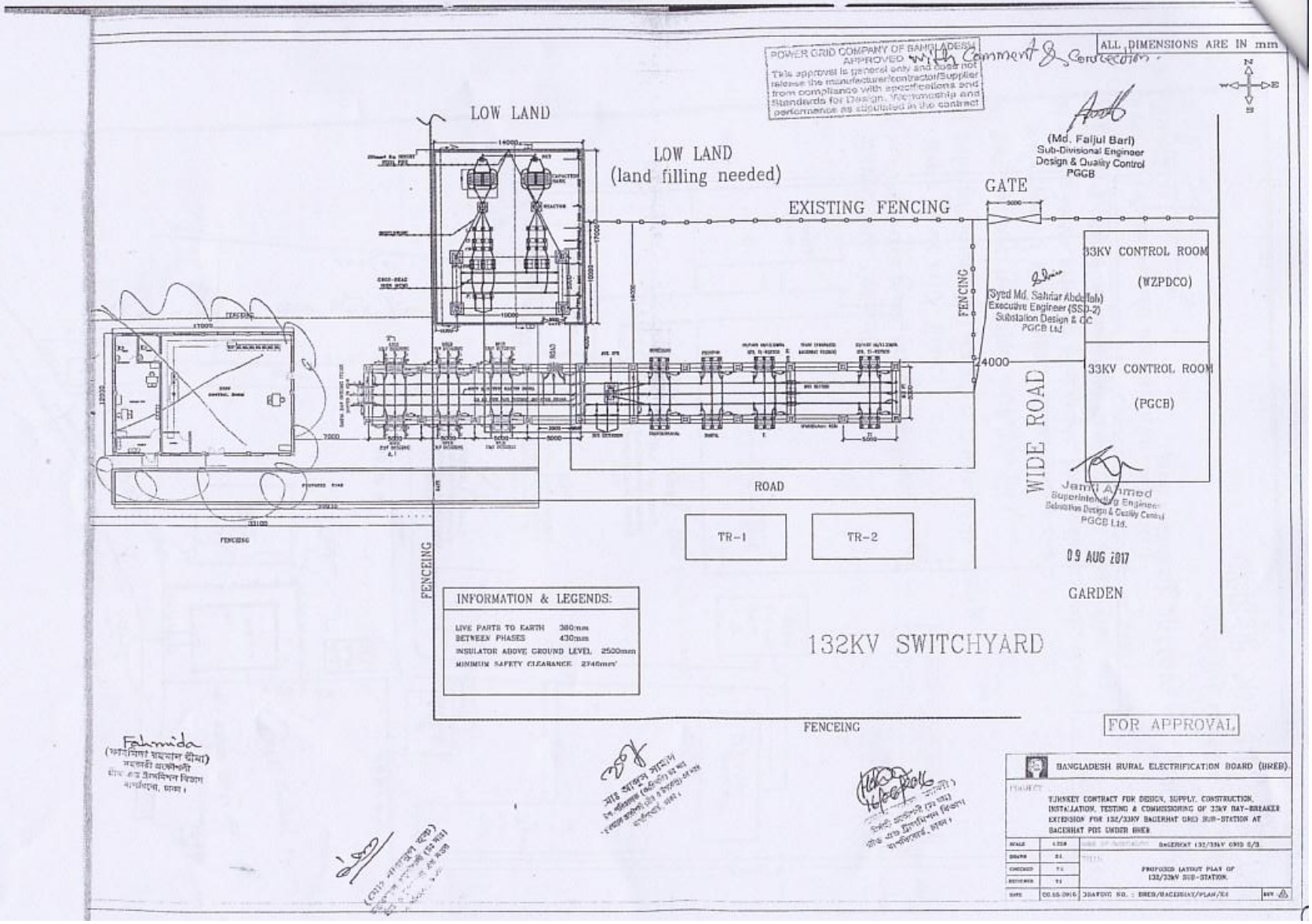
BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)

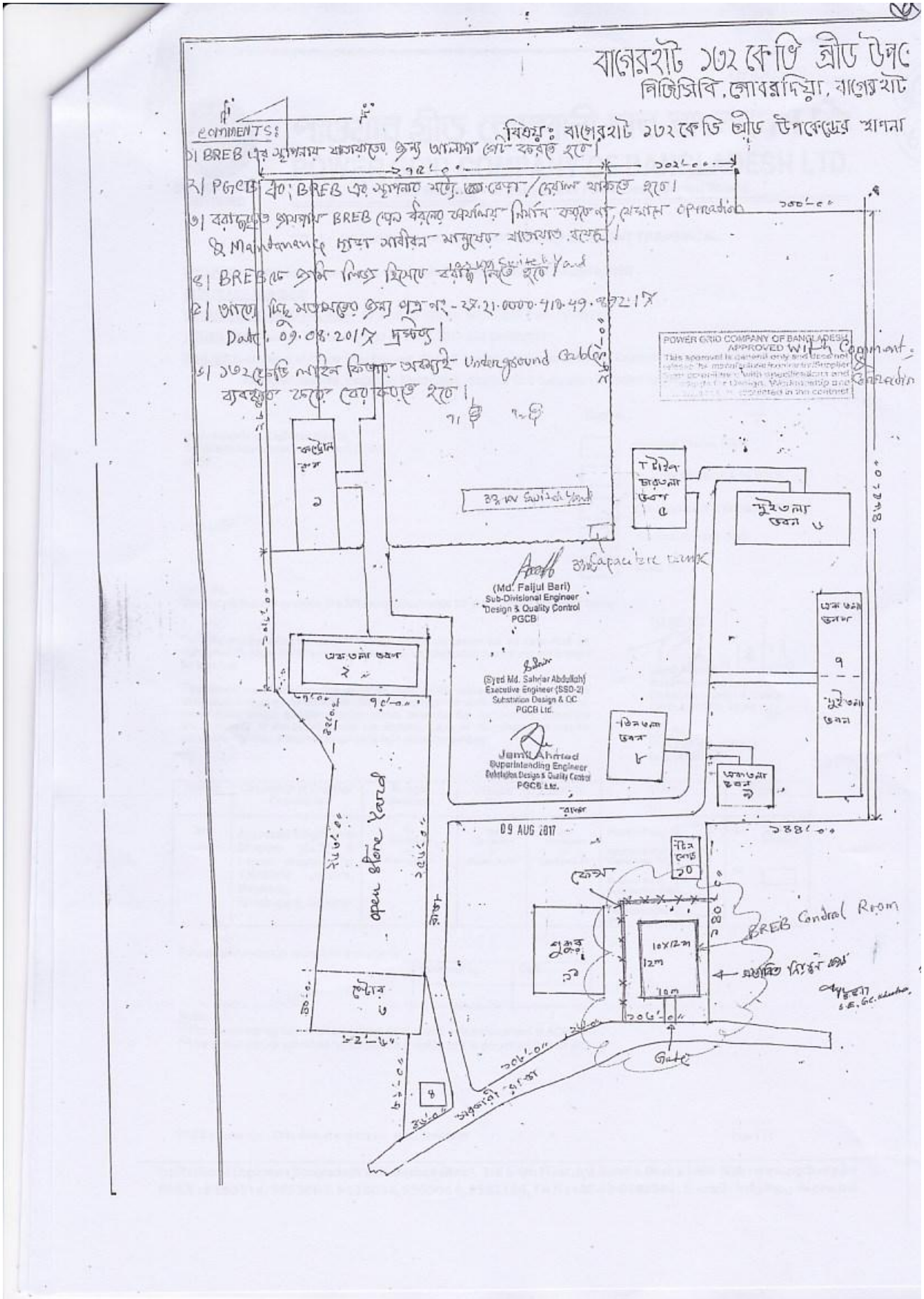
TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY-BREAKER EXTENSION FOR 132/33kV BAGERHAT GRID SUB-STATION AT BAGERHAT PBS UNDER BREB

SCALE	NTS	BAGERHAT 132/33kV GRID S/S.
DRAWN	TI	NEW CONTROL ROOM LAYOUT PLAN OF 132/33kV SUB-STATION.
CHECKED	TI	
DESIGNED	TI	
DATE	26.05.2015	DRAWING NO. : BREB/BAGERHAT/PLAN/EH REV

Fahmida


ALL DIMENSIONS ARE IN
MONGLA
GOALPARA
132 kV BUS
T-1
132/33kV
25/41MVA
33kV BUS
BUS PT
T-1
33/11kV
10/13.3MVA
SPARE (PNGPUSED BACERHAT FEEDER)
SPARE REB
PIROJPUR
RAMPAL
MORELGONJ
CHANDIMAHOL
SPARE BAY
AUX. Tsr.
33/0.4kV
CAPACITOR
REACTOR
33kV BREB OUTGOING FEEDER
33kV BUS 2500A
RAMPAL 33kV OUTGOING FEEDER SHIFTED TO HERE
POWER GRID COMPANY OF BANGLADESH
APPROVED With Comments & Correction
This approval is general only and does not release the manufacturer/contractor/supplier from compliance with specifications and Standards for Design, Workmanship and performance as stipulated in the contract
(Md. Faijul Bari)
Sub-Divisional Engineer
Design & Quality Control
PGCB
(Syed Md. Sahriar Abdullah)
Executive Engineer (SSD-2)
Substation Design & QC
PGCB Ltd.
Jemi Ahmed
Superintending Engineer
Substation Design & Quality Control
PGCB Ltd.
09 AUG 2017
FOR APPROVAL
BANGLADESH RURAL ELECTRIFICATION BOARD (BREB)
PROJECT
TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33kV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION AT BAGERHAT PBS UNDER BREB
SCALE NTS
NAME OF SUBSTATION BAGERHAT 132/33kV GRID S/S.
DRAWN
CHECKED
DESIGNED
PROPOSED SINGLE LINE DIAGRAM OF 132/33kV SUB-STATION.
DATE 26.05.2015
DRAWING NO. : BREB/BAGERHAT/SLD/E2
REV.


POWER GRID COMPANY OF BANGLADESH
APPROVED with Comment & Correction.
This approval is general only and does not release the manufacturer/contractor/Supplier from compliance with specifications and Standards for Design, Workmanship and performance as stipulated in the contract
ALL DIMENSIONS ARE IN mm
LOW LAND
LOW LAND
(land filling needed)
EXISTING FENCING
GATE
(Md. Faijul Bari)
Sub-Divisional Engineer
Design & Quality Control
PGCB
33KV CONTROL ROOM
(WZPDCO)
Syed Md. Sahriar Abdullah)
Executive Engineer (SSD-2)
Substation Design & QC
PGCB Ltd
FENCING
4000
33KV CONTROL ROOM
(PGCB)
WIDE ROAD
ROAD
Jamil Ahmed
Superintending Engineer
Substation Design & Quality Control
PGCB Ltd.
09 AUG 2017
TR-1
TR-2
GARDEN
FENCING
INFORMATION & LEGENDS:
LIVE PARTS TO EARTH 380mm
BETWEEN PHASES 430mm
INSULATOR ABOVE GROUND LEVEL 2500mm
MINIMUM SAFETY CLEARANCE 2746mm
132KV SWITCHYARD
FENCEING
FOR APPROVAL
Fahmida
BANGLADESH RURAL ELECTRIFICATION BOARD (BREB).
TURNKEY CONTRACT FOR DESIGN, SUPPLY, CONSTRUCTION, INSTALLATION, TESTING & COMMISSIONING OF 33KV BAY-BREAKER EXTENSION FOR 132/33KV BAGERHAT GRID SUB-STATION AT BAGERHAT PDS UNDER BREB.
BAGERHAT 132/33kV GRID S/S.
PROPOSED LAYOUT PLAN OF 132/33kV SUB-STATION.
DRAWING NO. : BREB/BAGERHAT/PLAN/01


বাগেরহাট ১৩২ কেভি গ্রীড উপকেন্দ্র
পিজিসিবি, গোবরদিয়া, বাগেরহাট
বিষয়ঃ বাগেরহাট ১৩২ কেভি গ্রীড উপকেন্দ্রের স্থাপনা
COMMENTS:
POWER GRID COMPANY OF BANGLADESH
APPROVED With Comment
(Md. Faijul Bari)
Sub-Divisional Engineer
Design & Quality Control
PGCB
(Syed Md. Sahriar Abdullah)
Executive Engineer (SSO-2)
Substation Design & QC
PGCB Ltd.
Jamil Ahmed
Superintending Engineer
Substation Design & Quality Control
PGCB Ltd.
09 AUG 2017
open stone Yard
BREB Control Room
Gate